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MEDICAL ESSAYS
A N D
OBSERVATIONS,

Published by a
SOCIETY in EDINBURGH.

VOLUME IV.

The THIRD EDITION,
Revised and Enlarged by the AUTHORS.

E D I N B U R G H,

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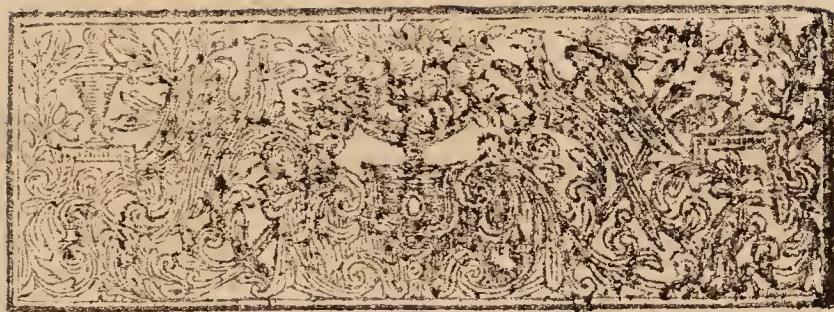
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Medical



Medical Essays A N D OBSERVATIONS.

ARTICLE I.

The Meteorological Register.

IOR understanding the following Observations, and comparing them with others, it is necessary to know the Form and Situation of the Instruments with which they were made, which are described in *Art. II.* of *Vol. I.*

VOL. IV.

A

JUNE

J U N E 1734.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.	Weather.	Rain.
		In. D.	In. D.	I. D.	Dir. For.		In. D.
1	9 a. m.	29	7	12	8 3	○ N. E.	○ cloudy -
	5 p. m.	29	7	13	1 2	1 E.	1 cloudy -
2	9 a. m.	29	7	13	4 2	2 S. E.	○ Rain - -
	6 p. m.	29	7	12	6 2	7 E. b. S.	○ Rain
3	9 a. m.	29	7	13	5 2	○ S. W.	1 fair - -
	5 p. m.	29	7	14	0 1	5 W.	1 fair
4	9 a. m.	29	8	13	6 1	6 W.	○ fair - -
	6 p. m.	29	8	14	9 1	4 W.	1 fair
5	8 a. m.	29	8	12	7 2	0 N.	○ fair - -
	7 p. m.	29	9	13	6 1	6 N. E.	○ cloudy
6	9 a. m.	29	9	12	4 1	8 E.	2 cloudy
	7 p. m.	29	8	12	5 1	5 E.	2 cloudy
7	9 a. m.	29	8	11	9 1	4 N. E.	2 fair - -
	5 p. m.	29	8	12	9 1	3 E.	1 fair
8	9 a. m.	29	9	12	3 1	5 E.	2 fair
	7 p. m.	29	9	12	1 1	5 E.	2 fair
9	9 a. m.	29	9	13	1 1	4 E.	1 fair
	9 p. m.	29	9	12	6 1	4 E.	1 cloudy
10	9 a. m.	30	0	13	2 1	4 E.	2 fair
	5 p. m.	30	0	13	1 1	4 E.	2 cloudy
11	9 a. m.	30	0	13	0 1	5 S. E.	○ cloudy
	5 p. m.	30	0	14	1 1	6 S. E.	○ fair
12	9 a. m.	30	0	14	8 1	5 N. W.	1 fair
	5 p. m.	30	0	15	7 1	3 N. W.	1 fair
13	9 a. m.	29	9	14	5 1	7 E.	○ fair
	7 p. m.	29	9	14	8 1	5 E.	1 fair
14	9 a. m.	29	9	13	2 2	2 N. E.	3 fair
	5 p. m.	29	8	13	2 1	9 N. E.	2 fair
15	9 a. m.	29	7	12	7 2	7 N. E.	2 cloudy
	8 p. m.	29	7	12	8 2	8 N. E.	2 fair
16	9 a. m.	29	7	13	7 1	6 N. E.	2 fair
	5 p. m.	29	8	13	6 1	7 N. E.	2 cloudy

J U N E 1734.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.	Weather.	Rain.
		In. D.	In. D.	I. D.	Dir. For.		
17	9 a. m.	29	9 12	9 1	9 N. E.	2 cloudy	1,382
	8 p. m.	29	9 14	1 1	7 N. E.	2 fair	0,035
18	9 a. m.	30	0 15	0 1	8 S. E.	1 fair	
	6 p. m.	30	0 16	5 1	3 S.	1 fair	
19	8 a. m.	30	0 16	8 1	4 S.	0 fair	
	6 p. m.	29	9 17	4 1	3 S. E.	2 fair	
20	9 a. m.	29	8 15	2 1	4 S. E.	1 fair	
	7 p. m.	29	8 15	6 1	2 S. E.	1 fair	
21	9 a. m.	29	8 14	3 2	0 N. E.	2 fair	
	7 p. m.	29	7 13	7 2	5 N. E.	2 Fog	
22	9 a. m.	29	7 14	8 3	1 N. W.	1 cloudy	
	8 p. m.	29	7 14	6 2	0 S. W.	0 fair	
23	9 a. m.	29	7 13	6 3	0 N. E.	2 Fog --	0,455
	8 p. m.	29	7 12	7 3	2 N. E.	2 Fog	
24	9 a. m.	29	7 12	2 3	7 N. E.	3 cloudy	0,234
	6 p. m.	29	7 12	1 3	3 N. E.	1 cloudy	
25	9 a. m.	29	6 13	1 3	0 E.	0 cloudy	0,035
	6 p. m.	29	6 13	9 2	6 E.	0 fair	
26	9 a. m.	29	6 13	9 2	3 W.	1 fair	
	8 p. m.	29	7 14	7 1	7 W.	1 fair	
27	9 a. m.	29	8 14	4 1	8 W.	1 fair	
	8 p. m.	29	8 15	0 1	5 W.	1 fair	
28	9 a. m.	29	8 14	6 1	4 W.	2 fair --	0,044
	7 p. m.	29	9 14	8 1	3 W.	2 fair	
29	9 a. m.	29	9 14	7 1	5 W.	2 fair	
	6 p. m.	29	9 15	6 1	2 W.	1 fair	
30	9 a. m.	29	7 14	3 1	7 S.	1 cloudy	0,027
	7 p. m.	29	5 14	4 1	8 S.	1 cloudy	

H. at med. 29 8 13 8 1 8 Total Depth 2,210

Gr. Height 30 0 17 4 3 7

L. Height 29 5 10 1 1 2

J U L Y 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29 6	13 3	1 8	W.	3 fair	
	7 p. m.	29 6	14 2	1 5	W.	3 fair	
2	9 a. m.	29 6	13 -3	1 6	W.	3 fair	
	8 p. m.	29 7	13 5	1 7	N. W.	2 fair	
3	9 a. m.	29 9	14 6	1 5	N.	1 fair --	0,050
	6 p. m.	30 0	14 5	1 5	N. E.	1 fair	
4	9 a. m.	30 1	14 4	1 4	N. E.	2 fair	
	7 p. m.	30 1	14 7	1 3	N.	1 fair	
5	9 a. m.	30 1	15 4	1 3	N.	0 fair	
	7 p. m.	30 1	15 4	1 3	N. W.	1 fair	
6	9 a. m.	30 1	14 6	1 5	W.	1 fair	
	8 p. m.	30 1	14 8	1 3	W.	1 fair	
7	9 a. m.	30 0	14 5	1 8	E.	1 cloudy	
	5 p. m.	30 0	14 6	1 4	E.	1 fair	
8	9 a. m.	30 1	14 6	1 7	E.	1 fair --	0,114
	7 p. m.	30 1	15 0	1 4	E.	1 fair	
9	9 a. m.	30 0	15 6	1 6	S. E.	1 fair --	0,056
	5 p. m.	30 0	15 3	1 5	S. E.	1 fair	
10	9 a. m.	30 0	15 3	1 8	N. W.	1 cloudy	
	5 p. m.	30 0	16 4	1 5	N. W.	1 fair	
11	9 a. m.	29 9	15 5	1 4	W.	2 cloudy	
	6 p. m.	29 9	15 4	1 4	S. W.	2 cloudy	
12	9 a. m.	29 7	15 3	1 4	W.	2 fair	
	7 p. m.	29 6	14 7	1 5	S. W.	1 Rain	
13	9 a. m.	29 4	14 6	1 7	S. W.	2 fair --	0,074
	7 p. m.	29 4	15 5	1 3	S. W.	2 fair	
14	9 a. m.	29 3	14 9	1 4	W.	2 cloudy	
	6 p. m.	29 3	13 1	2 0	N.	2 Rain	
15	9 a. m.	29 6	12 6	1 9	N. W.	1 cloudy	
	7 p. m.	29 7	13 6	1 3	N. W.	1 cloudy	
16	9 a. m.	29 5	14 6	1 8	S. W.	2 cloudy	
	6 p. m.	29 5	14 8	1 4	W.	2 cloudy	

0,294

JULY 1734.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.	Weather.	Rain.
		In. D.	In. D.	I. D.	Dir. For.		
17	9 a. m.	29 5	13 9	1 6	W.	1 fair	0,294
	5 p. m.	29 6	13 7	1 6	E.	1 cloudy	
18	9 a. m.	29 8	12 6	1 6	E.	2 fair - -	0,030
	6 p. m.	29 9	13 7	1 3	E.	2 fair	
19	9 a. m.	29 9	14 3	1 4	W.	2 fair	
	5 p. m.	29 8	15 3	1 2	S. W..	2 cloudy	
20	9 a. m.	29 6	13 7	1 5	W.	3 cloudy -	0,053
	6 p. m.	29 7	14 0	1 4	W.	3 cloudy	
21	9 a. m.	29 7	14 4	1 6	N. W.	2 cloudy	
	6 p. m.	29 7	14 6	1 6	N. W.	2 cloudy	
22	9 a. m.	29 9	14 7	1 8	W.	2 fair	
	7 p. m.	29 9	15 6	1 6	N. W.	2 fair	
23	9 a. m.	29 9	15 3	1 5	N. W.	2 fair	
	7 p. m.	29 9	16 5	1 5	W.	2 fair	
24	9 a. m.	29 8	16 0	1 9	N. b. W.	1 Fog	
	8 p. m.	29 8	15 3	1 6	N. W.	1 cloudy	
25	9 a. m.	29 8	15 6	1 6	W.	1 fair -	0,190
	5 p. m.	29 8	15 0	1 7	W.	1 fair	
26	9 a. m.	29 5	15 1	2 6	S. E.	1 hazy - -	0,020
	6 p. m.	29 5	15 0	1 9	S. E.	2 Rain	
27	9 a. m.	29 4	14 3	2 4	E.	2 Fog	
	6 p. m.	29 3	15 0	2 1	E..	1 cloudy	
28	9 a. m.	29 3	14 1	3 0	E.	1 Rain	
	6 p. m.	29 4	13 5	3 5	E..	1 Fog	
29	9 a. m.	29 5	13 7	3 8	E.	1 Fog - -	0,076
	8 p. m.	29 6	14 6	2 9	E.	0 cloudy	
30	9 a. m.	29 7	14 3	2 7	E.	2 fair	
	8 p. m.	29 8	14 1	2 5	E..	1 fair	
31	9 a. m.	29 8	13 6	2 7	E..	1 cloudy -	0,046
	5 p. m.	29 8	14 2	2 1	E.	1 cloudy	

Total Depth 0,709

Gr. Height 30 1 16 5 3 8

AUGUST 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29 7	13 7	2 6	W.	2 cloudy	
	5 p. m.	29 8	14 3	2 7	E.	2 Rain	
2	9 a. m.	30 0	12 6	1 9	W. b. N.	2 fair - -	0,045
	6 p. m.	30 0	14 2	1 5	N. W.	2 fair	
3	9 a. m.	30 0	13 0	1 8	N. W.	2 fair - -	0,090
	5 p. m.	30 1	14 7	1 5	N. E.	2 fair	
4	9 a. m.	30 0	14 0	1 7	N. W.	2 fair - -	0,180
	5 p. m.	29 9	15 6	1 5	W. b. N.	2 fair	
5	9 a. m.	29 9	14 4	2 3	N. W.	2 hazy	
	7 p. m.	29 8	14 5	2 2	W.	2 cloudy	
6	9 a. m.	29 8	14 9	1 6	W.	1 hazy -	0,260
	7 p. m.	29 9	14 6	1 6	W.	1 hazy	
7	9 a. m.	29 7	14 5	1 7	S. W.	2 cloudy	
	7 p. m.	29 7	14 4	1 9	W.	2 cloudy	
8	9 a. m.	29 7	13 5	1 7	W.	1 fair	
	7 p. m.	29 7	14 3	1 4	W.	1 fair	
9	9 a. m.	29 6	13 8	2 1	E.	1 hazy -	0,340
	7 p. m.	29 5	14 7	2 6	E.	1 Fog	
10	9 a. m.	29 2	14 4	3 0	E.	1 hazy -	0,115
	7 p. m.	29 0	12 7	4 9	N.	1 Rain	
11	9 a. m.	29 1	12 5	3 0	W.	2 Rain	
	6 p. m.	29 2	12 9	2 5	W.	2 Rain	
12	9 a. m.	29 6	13 5	2 2	W.	2 fair	
	7 p. m.	29 7	13 6	1 8	W.	1 clear	
13	9 a. m.	29 7	13 3	2 0	W.	1 fair	
	7 p. m.	29 6	13 8	1 7	S. W.	1 fair	
14	9 a. m.	29 7	13 7	1 8	S. W.	1 fair	
	7 p. m.	29 6	14 0	1 6	S. S. W.	1 cloudy	
15	9 a. m.	29 6	13 9	2 0	S. W.	1 cloudy -	0,090
	7 p. m.	29 6	14 3	1 5	W.	1 cloudy	
16	9 a. m.	29 6	13 7	1 8	W.	2 fair	
	7 p. m.	29 6	14 0	1 6	W.	1 fair	

1,120

AUGUST 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	29 7	13	5 2	N. E.	2 fair	1,120
	7 p. m.	29 7	13	7 1 8	N. E.	1 fair - -	0,050
18	9 a. m.	29 9	13	5 1	S. W.	1 fair	
	7 p. m.	29 8	13	6 1	S. W.	1 fair	
19	9 a. m.	29 7	13	7 1	W.	2 cloudy	
	7 p. m.	29 7	13	6 1	S. W.	2 fair	
20	9 a. m.	29 8	13	3 1	W. b. S.	2 fair	
	7 p. m.	29 9	12	7 1	W.	1 fair	
21	9 a. m.	30 1	12	8 1	W.	1 fair	
	7 p. m.	30 1	13	6 1	E.	1 cloudy	
22	9 a. m.	29 9	13	7 1	S. E.	2 cloudy	
	7 p. m.	29 8	13	6 1	S. b. E.	1 Rain	
23	9 a. m.	29 6	14	0 2	S. E.	1 Rain	
	7 p. m.	29 4	14	4 2	S. W.	1 Rain	
24							
25	9 a. m.	29 5	13	8 1	W.	2 fair - -	0,060
	6 p. m.	29 5	14	4 1	W. b. S.	2 fair	
26	9 a. m.	29 3	14	8 1	W. b. S.	3 clear - -	0,020
	7 p. m.	29 4	13	1 1	W.	3 clear	
27	9 a. m.	29 7	13	5 1	W.	3 cloudy	
	7 p. m.	29 7	13	2 1	W.	1 cloudy	
28	9 a. m.	29 8	13	5 2	W.	1 fair	
	7 p. m.	29 7	13	0 1	E.	1 Rain	
29	9 a. m.	29 4	12	7 2	S. E.	2 Rain	
	7 p. m.	29 4	13	8 1	E. b. S.	1 cloudy	
30	9 a. m.	28 9	13	3 2	S. W.	1 fair - -	0,035
	7 p. m.	28 8	13	1 1	S. W.	1 cloudy	
31	9 a. m.	28 7	13	8 1	S. W.	1 fair	
	7 p. m.	28 8	13	9 1	S. W.	2 cloudy	
H. at a med.		29 6	13 3	1 9		Total Depth 1,285	
Gr. Height 30 1		15	6 4 9				
L. Height 28 7		12	5 1 4				

SEPTEMBER 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	28 9	13 3	1 9	W.	fair - -	0,025
	7 p. m.	29 2	12 0	1 9	W.	fair	
2	9 a. m.	29 4	12 7	1 8	W.	fair	
	7 p. m.	28 9	11 8	1 2	W.	Rain	
3	9 a. m.	28 9	11 8	1 7	W.	fair	
	6 p. m.	28 9	12 3	1 6	S. W.	fair	
4	9 a. m.	29 3	12 7	1 5	N. W.	fair - -	0,078
	5 p. m.	29 5	13 0	1 5	N. W.	fair	
5	9 a. m.	29 6	12 9	2 3	W.	cloudy	
	5 p. m.	29 7	12 8	2 1	W.	fair	
6	9 a. m.	29 8	12 8	1 9	S. E.	cloudy	
	5 p. m.	29 7	12 7	1 7	W.	Rain	
7	9 a. m.	29 8	13 5	2 4	W.	fair	
	5 p. m.	29 9	12 7	1 6	W.	fair	
8	9 a. m.	29 9	12 5	1 9	S. W.	cloudy	
	5 p. m.	29 8	13 1	1 8	S. W.	cloudy	
9	9 a. m.	29 6	11 3	2 3	N. E.	Rain - -	0,130
	5 p. m.	29 7	11 3	1 7	N.	fair	
10	9 a. m.	29 8	11 6	1 6	N. W.	fair - -	0,065
	6 p. m.	30 0	11 2	1 5	N. W.	fair	
11	9 a. m.	30 0	11 6	1 6	N. W.	cloudy	
	5 p. m.	30 0	12 5	1 7	W. b. S.	cloudy -	0,090
12	9 a. m.	30 0	12 3	1 8	S. W.	cloudy	
	5 p. m.	30 0	13 2	1 5	S. W.	cloudy	
13	9 a. m.	30 0	12 3	1 8	W.	fair	
	5 p. m.	29 9	12 5	1 6	W.	cloudy	
14	9 a. m.	29 8	11 7	1 9	W.	fair	
	5 p. m.	29 8	12 4	1 5	N. W.	fair	
15	9 a. m.	29 8	12 1	1 8	W.	cloudy	
	5 p. m.	29 8	12 8	1 9	W.	cloudy	
16	9 a. m.	29 8	12 1	2 0	W.	fair	
	6 p. m.	29 9	12 1	1 7	W.	fair	

0,544

SEPTEMBER 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	29 9	12	8 1	8 S.	2 cloudy	0,544
	4 p. m.	29 9	14	4 1	7 S. W.	2 fair	
18	9 a. m.	30 0	13	8 1	9 S. W.	3 fair - -	0,260
	5 p. m.	30 0	14	1 1	7 S. W.	2 cloudy	
19	9 a. m.	30 0	12	5 1	9 W.	1 cloudy	
	5 p. m.	29 9	11	3 2	1 W.	1 cloudy	
20	9 a. m.	29 7	11	8 2	9 S. W.	1 fair - -	0,127
	5 p. m.	29 6	12	0 2	8 S. W.	1 cloudy	
21	9 a. m.	29 4	11	9 2	0 S. W.	1 fair	
	5 p. m.	29 2	11	9 1	8 S. W.	1 fair	
22	9 a. m.	28 7	10	7 1	9 W.	3 Rain	
	5 p. m.	28 8	11	9 1	9 W.	2 cloudy	
23	9 a. m.	29 4	11	2 1	7 N. W.	2 fair	
	4 p. m.	29 5	11	8 1	7 W.	1 Rain	
24	9 a. m.	29 3	11	5 2	2 N. W.	1 fair	
	4 p. m.	29 3	12	2 1	9 N.	1 cloudy	
25	9 a. m.	29 7	10	7 2	0 N.	2 fair - -	0,090
	5 p. m.	29 9	11	1 1	6 N.	2 fair	
26	9 a. m.	30 0	10	1 1	7 W. b. N.	2 cloudy -	0,039
	4 p. m.	29 9	11	0 1	8 W.	2 cloudy	
27	9 a. m.	29 8	12	0 2	6 N. E.	1 cloudy	
	5 p. m.	29 8	11	8 1	9 E. b. N.	1 cloudy	
28	9 a. m.	29 7	11	6 1	9 E.	1 fair	
	4 p. m.	29 7	12	2 1	7 E.	1 fair	
29	9 a. m.	29 7	11	6 1	8 W.	2 cloudy -	0,116
	5 p. m.	29 7	10	0 1	8 W.	2 cloudy	
30	9 a. m.	29 3	9	9 2	2 S. W.	3 Rain	
	4 p. m.	29 3	10	6 2	0 S. W.	1 cloudy	
<hr/>							
H. at a med.	29	6	12	0 1	8	Total Depth	1,172
<hr/>							
Gr. Height	30	0	14	4 2	9		
<hr/>							
L. Height	28	7	9	9 1	2		

O C T O B E R 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For	Weather.	Rain. In. D.
1	9 a. m.	28 8	12 4	2 2	S. W.	Rain	
	5 p. m.	28 8	11 0	2 0	S. W.	fair	
2	9 a. m.	28 8	11 4	1 9	S. W.	fair	
	4 p. m.	29 1	11 6	1 7	S. W.	fair	
3	9 a. m.	29 1	10 6	1 9	S. W.	Fog - -	0,096
	5 p. m.	29 0	10 4	2 2	N. W.	cloudy	
4	9 a. m.	29 3	10 6	2 2	S.	fair	
	5 p. m.	29 4	11 2	2 1	S.	fair	
5	9 a. m.	29 5	11 2	2 3	N.	cloudy	
	4 p. m.	29 5	11 5	2 1	N.	cloudy	
6	9 a. m.	29 5	11 6	3 0	E.	Fog	
	4 p. m.	29 3	11 6	2 4	E.	cloudy -	0,107
7	9 a. m.	29 1	10 4	3 1	N. E.	Rain	
	4 p. m.	29 2	10 7	3 2	N.	lowring	0,037
8	9 a. m.	29 5	10 6	2 6	W.	cloudy	
	5 p. m.	29 5	10 5	1 8	W.	cloudy	
9	9 a. m.	29 4	10 5	2 2	W.	cloudy	
	4 p. m.	29 4	10 0	2 2	W.	cloudy	
10	9 a. m.	29 5	10 2	2 4	W.	fair	
	5 p. m.	29 6	10 4	2 0	S. W.	cloudy -	0,130
11	9 a. m.	29 5	10 3	2 3	S.	cloudy	
	4 p. m.	29 3	10 6	2 3	S.	Rain	
12	9 a. m.	29 1	9 9	2 3	S.	fair	
	4 p. m.	29 1	10 8	2 0	S.	fair	
13	9 a. m.	29 1	10 6	2 2	S. E.	fair	
	4 p. m.	29 2	11 0	0 1	N. E.	cloudy	
14	9 a. m.	29 5	10 3	3 3	0 N.	cloudy -	0,090
	5 p. m.	29 6	10 4	2 9	N.	fair	
15	9 a. m.	29 6	10 7	2 9	N. E.	fair - -	0,030
	4 p. m.	29 6	10 4	2 7	N. E.	cloudy	
16	9 a. m.	29 6	9 4	2 5	N. W.	fair - -	0,290
	5 p. m.	29 7	10 2	2 2	N. W.	fair	

0,780

O C T O B E R 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	29 9	9 9	7 2	N. W.	2 fair	0,780
	4 p. m.	29 9	10 3	2 0	N. b. W.	1 fair	
18	9 a. m.	30 0	9 2	2 1	N. W.	1 fair	
	4 p. m.	29 9	10 6	2 0	N. W.	1 cloudy	
19	9 a. m.	30 0	9 5	2 0	N.	4 fair	
	5 p. m.	30 1	9 3	2 0	N. E.	2 fair	
20	9 a. m.	30 0	9 5	2 0	W.	2 cloudy	
	5 p. m.	30 0	9 2	1 9	W. b. N.	0 cloudy	0,075
21	9 a. m.	30 0	10 2	2 6	N. W.	1 hazy	
	4 p. m.	30 0	10 3	2 8	N. W.	1 cloudy	
22	9 a. m.	30 2	9 5	2 6	W.	1 fair	
	5 p. m.	30 2	10 0	2 4	W.	1 fair	
23	9 a. m.	30 1	10 0	2 6	W.	2 fair	
	4 p. m.	30 0	10 8	2 6	W.	2 cloudy	
24	9 a. m.	29 9	11 8	3 0	W.	2 Rain	
	4 p. m.	29 8	12 2	3 0	W. b. S.	1 cloudy	
25	9 a. m.	30 0	10 9	2 5	S. W.	3 cloudy	
	4 p. m.	29 9	11 5	2 8	S. W.	3 cloudy	
26	9 a. m.	29 8	11 3	2 0	N. W.	4 fair	0,179
	4 p. m.	29 7	11 0	1 9	N. W.	4 cloudy	
27	9 a. m.	29 7	9 5	1 8	N. W.	3 fair	0,094
	4 p. m.	29 8	9 3	1 6	N. W.	3 cloudy	
28	9 a. m.	29 8	9 0	1 7	N. W.	2 fair	0,055
	4 p. m.	29 8	9 8	1 6	N. W.	1 cloudy	
29	9 a. m.	29 5	9 3	2 2	S. W.	0 Fog	
	4 p. m.	29 4	9 4	2 3	S. W.	1 fair	
30	9 a. m.	29 5	9 3	2 3	S. W.	2 fair	0,085
	4 p. m.	29 6	9 8	2 0	S. W.	2 fair	
31	9 a. m.	29 4	10 9	2 1	S. W.	1 cloudy	0,053
	4 p. m.	29 3	11 5	2 0	S. E.	2 cloudy	
<hr/>							
H. at a med.	29 5	10 3	2 2			Total Depth	1,321
<hr/>							
Gr. Height	30 2	12 4	3 2				
<hr/>							
L. Height	28 8	9 0	1 6				

N O V E M B E R 1734.

D.	Hour.	Baro. In D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In.D.
1	9 a. m.	29 7	9 3	2 0	S. W.	fair	
	4 p. m.	29 9	10 4	2 0	S. W.	fair	
2	9 a. m.	30 0	10 3	2 1	S.	fair - -	0,130
	4 p. m.	30 0	10 7	2 0	S.	fair	
3	9 a. m.	29 8	11 6	2 1	S.	cloudy -	0,070
	4 p. m.	29 9	10 8	2 1	S.	fair	
4	9 a. m.	29 8	10 4	2 1	S.	cloudy	
	4 p. m.	29 7	10 6	2 0	S.	fair	
5	9 a. m.	29 8	10 4	2 1	S. W.	fair	
	4 p. m.	29 8	10 5	2 1	S. W.	fair	
6	9 a. m.	29 9	10 2	2 3	S. W.	cloudy	
	4 p. m.	29 9	10 6	2 1	S. b. W.	cloudy	
7	9 a. m.	29 8	10 6	2 0	S. W.	cloudy	
	4 p. m.	29 9	10 1	2 0	S. W.	fair	
8	9 a. m.	30 2	9 0	2 3	S. W.	Frost	
	4 p. m.	30 2	9 0	2 2	S. W.	fair	
9	9 a. m.	30 2	9 1	2 5	S. W.	Mist - -	0,180
	4 p. m.	30 2	9 3	2 7	S. W.	fair	
10	9 a. m.	30 2	8 5	2 3	S. W.	Frost Fog	
	4 p. m.	30 2	8 6	2 2	S. W.	Frost fair	0,075
11	9 a. m.	30 2	8 2	2 1	S. W.	fair	
	4 p. m.	30 2	8 2	2 1	S. W.	fair	
12	9 a. m.	30 2	7 9	2 2	S. W.	Frost Fog	0,094
	4 p. m.	30 3	8 3	2 1	S. W.	Frost fair	
13	9 a. m.	30 4	8 2	2 4	S. W.	Fog	
	4 p. m.	30 4	8 9	2 4	S. W.	cloudy	
14	9 a. m.	30 4	9 0	2 5	S. b. E.	Fog	
	4 p. m.	30 4	9 4	2 2	S. b. E.	Fog	
15	9 a. m.	30 4	9 5	2 1	S. E.	Fog	
	4 p. m.	30 4	9 8	2 0	S. E.	Fog	
16	9 a. m.	30 4	9 4	2 0	S. E.	cloudy	
	4 p. m.	30 3	9 2	2 0	S. W.	cloudy	

0,549

NOVEMBER 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	30 2	9 2	2 2	W.	1 cloudy	0,549
	4 p. m.	30 2	9 1	2 0	W.	2 cloudy	0,144
18	9 a. m.	30 1	8 1	2 3	W.	1 fair --	0,090
	4 p. m.	30 0	8 9	2 2	W.	1 fair	
19	9 a. m.	29 9	9 2	2 5	S.	1 Fog	
	4 p. m.	29 9	9 4	2 3	S. b. E.	1 Fog	
20	9 a. m.	29 8	8 8	2 2	S. W.	1 Fog	
	4 p. m.	29 7	9 3	2 3	S. W.	1 Fog	
21	9 a. m.	29 7	8 7	2 3	W.	1 fair	
	4 p. m.	29 7	9 5	2 3	W.	1 cloudy	
22	9 a. m.	29 5	8 6	2 3	S. W.	2 fair --	0,385
	4 p. m.	29 5	8 5	2 2	W.	2 fair	
23	9 a. m.	29 4	7 8	2 2	W.	0 Fog	
	4 p. m.	29 3	8 5	2 3	S. E.	1 Fog	
24	9 a. m.	29 4	9 0	1 9	N. E.	2 cloudy -	0,130
	4 p. m.	29 5	9 0	1 6	N. E.	2 cloudy	
25	9 a. m.	29 7	8 1	2 6	S. E.	1 Snow	
	4 p. m.	29 8	8 6	2 2	S. E.	1 cloudy	
26	9 a. m.	29 9	8 3	2 4	N.	3 fair --	0,150
	4 p. m.	30 0	7 9	2 0	N.	2 fair	
27	9 a. m.	30 2	7 7	2 0	W.	1 Frost	
	4 p. m.	30 2	7 9	2 0	W.	1 Frost	
28	9 a. m.	29 6	10 3	2 3	S. W.	3 Thaw -	0,090
	4 p. m.	29 7	11 2	1 6	S. W.	2 fair	
29	9 a. m.	29 6	11 6	2 6	S.W.b.W.	2 fair --	0,070
	4 p. m.	29 6	11 7	2 7	S.W.b.W.	2 cloudy	
30	9 a. m.	29 6	9 7	2 6	W.	2 fair	
	4 p. m.	29 5	10 5	2 3	W.	2 cloudy	
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H. at a med.	29	9	3	2	1	Total Depth 1,608	
Gr. Height	30	4	11	7	2		
L. Height	29	3	7	7	1		

D E C E M B E R 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29 1	11 5	2 3	S. W.	3 cloudy	- 0,094
	4 p. m.	28 9	11 5	2 3	S. W.	2 cloudy	
2	9 a. m.	29 0	8 7	2 3	S. W.	2 fair	- - 0,067
	4 p. m.	29 1	8 8	2 2	S. W.	2 fair	
3	9 a. m.	29 1	8 3	2 3	S. b. E.	2 fair	
	4 p. m.	29 1	8 8	2 3	S. b. E.	1 fair	
4	9 a. m.	29 2	8 0	2 4	S.	1 Fog	- 0,190
	4 p. m.	29 2	8 4	2 3	S.	1 cloudy	-
5	9 a. m.	28 9	9 1	2 5	E.	2 Fog	- - 0,050
	4 p. m.	28 9	9 5	2 8	E.	2 Rain	
6	9 a. m.	29 1	9 5	3 0	W.	2 cloudy	
	4 p. m.	29 2	9 7	3 0	W.	2 hazy	
7	9 a. m.	29 3	9 0	2 8	W. b. N.	2 fair	- - 0,090
	4 p. m.	29 5	8 8	2 5	N. W.	2 fair	
8	9 a. m.	29 4	9 0	2 6	S. W.	1 cloudy	
	4 p. m.	29 3	10 1	2 4	S. W.	2 cloudy	
9	9 a. m.	29 0	10 0	2 5	S. W.	2 fair	
	4 p. m.	29 2	9 6	2 4	S. W.	2 fair	
10	9 a. m.	29 3	8 9	2 3	S.	3 fair	
	4 p. m.	29 3	9 5	2 3	S.	2 fair	
11	9 a. m.	28 8	8 5	2 8	N. W.	3 cloudy	- 0,156
	4 p. m.	29 0	8 8	2 3	N. W.	3 fair	
12	9 a. m.	29 2	9 3	2 4	S.	1 fair	- - 0,060
	4 p. m.	29 1	9 2	2 3	S.	1 fair	
13	9 a. m.	28 6	9 4	3 0	S. E.	1 Fog	
	3 p. m.	28 6	9 4	2 8	S. E.	2 cloudy	- 0,075
14	9 a. m.	28 0	9 1	2 6	S.	2 hazy	
	4 p. m.	28 0	9 1	2 3	S.	2 cloudy	
15	9 a. m.	28 3	9 3	2 2	N. E.	2 fair	
	4 p. m.	28 6	9 1	2 5	N. E.	2 Rain	
16	9 a. m.	29 0	8 4	2 3	W. b. N.	2 fair	- - 0,460
	4 p. m.	29 1	8 8	2 5	W. b. N.	2 fair	

D E C E M B E R 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	28	9	8	6 2 5	S. E.	1 Fog --
	4 p. m.	28	9	9	0 2 5	S. E.	1 hazy
18	9 a. m.	28	9	9	0 2 5	S. W.	2 cloudy -
	4 p. m.	28	9	8	9 2 3	S. W.	2 fair
19	9 a. m.	29	0	9	5 2 3	S. W.	3 cloudy
	4 p. m.	29	1	9	8 2 3	S. W.	3 fair
20	9 a. m.	29	5	9	3 2 5	S. W.	2 fair
	4 p. m.	29	6	9	2 2 5	S. W.	1 fair
21	9 a. m.	29	6	8	6 2 3	S. W.	2 Fog
	4 p. m.	29	6	8	8 2 6	S. W.	2 cloudy
22	9 a. m.	29	8	7	9 2 5	W.	1 fair
	4 p. m.	29	8	8	5 2 6	W.	1 Fog
23	9 a. m.	29	8	7	4 2 8	S. b. E.	2 fair
	4 p. m.	29	8	8	1 2 7	S. b. E.	1 Fog
24	9 a. m.	29	6	10	6 2 7	S. W.	2 cloudy -
	4 p. m.	29	5	10	3 2 7	S. W.	2 cloudy
25	9 a. m.	29	7	8	3 2 5	W.	2 fair --
	4 p. m.	29	7	8	8 2 5	W.	2 fair
26	9 a. m.	29	5	9	9 2 3	S. b. W.	4 cloudy
	4 p. m.	29	1	10	7 2 3	S. b. W.	4 cloudy
27	9 a. m.	29	3	9	2 2 2	S. b. W.	3 fair
	4 p. m.	29	1	10	0 2 2	S. b. W.	3 cloudy
28	9 a. m.	28	6	9	9 2 6	S. b. W.	2 fair
	4 p. m.	28	9	10	2 2 0	W. b. N.	3 cloudy
29	9 a. m.	29	0	8	8 2 2	S. b. E.	1 Fog --
	4 p. m.	29	0	9	0 2 2	S. b. E.	1 cloudy
30	9 a. m.	29	5	8	3 2 3	S. b. W.	1 fair
	4 p. m.	29	8	9	0 1 9	S. b. W.	2 fair
31	9 a. m.	29	6	9	6 2 1	S. W.	4 cloudy
	4 p. m.	29	8	9	0 2 3	S. W.	2 cloudy
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H. at a med.	29	0	9	1 2 4		Total Depth	2,332
Gr. Height	29	8	11	5 3 0			
L. Height	28	0	7	4 1 9			

JANUARY 1735.

D.	Hour.	Baro.		Ther.		Hyg		Wind.		Weather.		Rain. In.D.
		In.	D.	In.	D.	I.	D.	Dir.	For.			
1	9 a. m.	29	9	9	2	2	3	W.	b.	S.	2	fair
	4 p. m.	30	0	9	3	2	3	W.			2	fair
2	9 a. m.	29	8	10	7	2	3	S.	W.		4	cloudy - 0,147
	4 p. m.	29	6	11	5	2	3	S.	W.		4	Rain
3	9 a. m.	29	9	9	0	2	3	S.	W.		3	fair
	4 p. m.	29	9	9	7	2	3	W.			3	cloudy
4	9 a. m.	30	2	9	0	2	3	W.			3	fair - - 0,096
	4 p. m.	30	2	10	5	2	2	S.	W.		3	cloudy
5	9 a. m.	30	0	11	1	2	6	S.	b.	W.	3	cloudy
	4 p. m.	29	8	11	3	2	6	W.			4	cloudy
6	9 a. m.	29	6	11	4	2	6	W.			3	cloudy
	4 p. m.	29	3	11	6	2	4	S.	W.		4	Rain
7	9 a. m.	28	7	8	7	2	1	S.	W.		4	fair
	4 p. m.	28	6	9	1	2	2	W.			3	cloudy
8	9 a. m.	28	4	8	3	2	3	S.			1	Fog
	4 p. m.	28	2	8	5	2	3	N.			1	fair
9	9 a. m.	28	4	8	3	2	7	W.			1	fair - - 0,195
	4 p. m.	28	6	8	4	2	6	W.			2	fair
10	9 a. m.	28	9	7	8	2	5	W.			2	fair
	4 p. m.	28	9	7	6	2	4	W.			1	Fog
11	9 a. m.	28	9	8	8	2	5	E.			2	cloudy
	4 p. m.	29	0	8	7	2	7	N.			2	cloudy
12	9 a. m.	29	5	7	7	2	2	N.	W.		2	fair - - 0,540
	4 p. m.	29	5	8	0	2	0	N.	W.		2	fair
13	9 a. m.	29	3	7	9	2	0	S.			2	Snow - 0,430
	4 p. m.	29	0	8	2	2	1	S.	E.		3	cloudy
14	9 a. m.	28	6	8	8	2	2	W.	b.	N.	4	cloudy
	4 p. m.	28	7	8	5	2	0	W.	b.	N.	3	cloudy
15	9 a. m.	29	1	9	1	2	2	W.			3	fair
	4 p. m.	29	2	9	2	2	3	W.			2	fair
16	9 a. m.	29	3	8	4	2	6	S.	W.		2	fair
	4 p. m.	29	3	8	6	2	5	W.			2	fair

1,408

JANUARY 1735.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	29 5	8	5 2	5 W.	2 fair --	1,408
	4 p. m.	29 5	9	3 2	3 W.	2 cloudy	0,290
18	9 a. m.	29 2	9	8 2	5 S. W.	2 cloudy -	0,057
	4 p. m.	29 1	10	6 2	6 S. W.	2 cloudy	.
19	9 a. m.	29 2	9	5 2	5 W.	2 cloudy	.
	4 p. m.	29 3	9	5 2	5 N.	3 cloudy	.
20	9 a. m.	29 7	8	7 2	3 N.	2 cloudy	.
	4 p. m.	29 8	8	2 2	2 N.	2 fair	.
21	9 a. m.	29 9	8	6 2	0 W. b. N.	2 fair --	0,250
	4 p. m.	29 8	8	7 2	0 S. W.	2 cloudy	.
22	9 a. m.	29 8	8	1 2	3 W.	2 fair	.
	4 p. m.	29 9	8	6 2	2 N.	2 fair	.
23	9 a. m.	29 8	8	4 2	1 E.	2 Fog	.
	4 p. m.	29 8	8	3 1	9 E.	2 cloudy	.
24	9 a. m.	29 8	8	0 1	9 N. W.	2 fair --	0,410
	4 p. m.	29 8	8	8 2	0 N. W.	2 fair	.
25	9 a. m.	29 8	8	8 2	3 W.	2 cloudy -	0,160
	4 p. m.	30 1	8	6 1	9 W.	2 cloudy	.
26	9 a. m.	30 0	9	7 2	6 W.	2 fair	.
	4 p. m.	29 9	10	6 2	7 W.	2 cloudy	.
27	9 a. m.	29 9	9	7 2	6 W.	2 fair --	0,130
	5 p. m.	29 9	10	0 2	2 W.	2 fair	.
28	9 a. m.	29 9	10	8 2	3 W.	3 cloudy	.
	4 p. m.	30 2	9	6 2	5 E.	2 Rain	.
29	9 a. m.	30 3	9	6 2	4 W.	2 cloudy	.
	4 p. m.	30 2	10	1 2	4 W.	2 fair	.
30	9 a. m.	30 2	9	9 2	8 W.	2 fair --	0,290
	5 p. m.	30 1	10	4 2	5 W.	2 cloudy	.
31	9 a. m.	30 2	9	7 3	0 W.	2 fair	.
	4 p. m.	30 3	10	6 2	3 W.	2 fair	.

H. at a med. 29 5 9 2 2 7 Total Depth 2,995

Gr. Height 30 3 11 6 3 0

L. Height 28 2 7 6 L 9

FEBRUARY 1735.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	30 4	9 3	2	8 W.	1 fair - -	0,094
5	p. m.	30 4	10 4	2	4 W.	1 fair	
2	9 a. m.	30 4	8 9	2	6 W.	1 fair	
4	p. m.	30 5	9 7	2	5 W.	1 cloudy	
3	9 a. m.	30 4	8 9	2	3 W.	2 cloudy -	0,165
5	p. m.	30 3	8 8	2	2 W.	2 cloudy	
4	9 a. m.	30 2	8 9	2	5 W.	2 cloudy	
5	p. m.	30 2	8 7	2	4 W.	2 cloudy	
5	9 a. m.	30 1	9 7	2	2 W.	3 fair - -	0,290
5	p. m.	30 0	10 4	2	1 S. W.	2 cloudy	
6	9 a. m.	30 0	10 3	2	8 S. W.	2 cloudy	
4	p. m.	29 9	10 6	2	2 S. W.	2 fair	
7	9 a. m.	29 6	10 3	2	1 S. W.	4 fair - -	0,460
5	p. m.	29 5	11 5	2	2 S. W.	4 cloudy	
8	9 a. m.	29 5	12 4	2	3 S. W.	2 fair - -	0,195
5	p. m.	29 5	12 1	2	2 S. W.	2 cloudy	
9	9 a. m.	29 6	10 5	2	4 S. W.	2 fair	
5	p. m.	29 7	10 8	2	0 S. W.	2 cloudy	
10	9 a. m.	29 6	9 4	2	0 S. W.	3 fair	
5	p. m.	29 5	10 2	2	1 S. W.	4 Rain	
11	9 a. m.	29 9	9 3	2	0 W.	2 fair	
4	p. m.	30 0	10 5	1	8 W. b. N.	1 Fog	
12	9 a. m.	30 1	10 7	2	7 W.	1 cloudy -	0,316
4	p. m.	30 0	11 3	2	2 W.	1 drizzling	
13	9 a. m.	29 9	10 9	2	3 S. W.	1 cloudy -	0,070
5	p. m.	29 8	10 8	2	1 W.	1 cloudy	
14	9 a. m.	29 7	10 6	2	2 S. W.	2 fair	
5	p. m.	29 7	10 9	2	1 S. W.	2 fair	
15	9 a. m.	29 8	8 9	2	1 W. b. N.	2 fair	
5	p. m.	29 9	9 9	2	1 W. b. N.	2 fair	
16	9 a. m.	30 0	9 9	6	2 3 S. W.	3 cloudy -	0,560
4	p. m.	29 8	10 8	2	2 S. W.	3 cloudy	

2,150

FEBRUARY 1735.

D.	Hour.	Baro. In. D.	Thier. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	29 5	9 8	2 2	S. W.	2 fair	2,150
	5 p. m.	29 4	9 5	2 3	W.	2 fair	
18	9 a. m.	29 3	8 7	2 3	N.	2 Snow	
	4 p. m.	29 3	9 4	2 0	N. E.	2 fair	
19	9 a. m.	29 4	8 5	2 2	N. E.	3 cloudy -	0,496
	4 p. m.	29 5	8 6	1 8	N. E.	3 fair	
20	9 a. m.	29 8	7 4	1 9	W.	2 fair -	0,170
	5 p. m.	29 8	9 1	1 8	W.	2 fair	
21	9 a. m.	29 9	8 6	2 2	N. W.	2 fair	
	4 p. m.	29 9	9 2	1 8	N. W.	2 fair	
22	8 a. m.	29 7	8 7	1 8	S. W.	3 fair	
	5 p. m.	29 5	9 6	1 9	S. W.	3 fair	
23	9 a. m.	28 9	9 5	2 1	S. W.	4 cloudy	
	6 p. m.	28 9	9 8	1 9	S. W.	3 fair	
24	9 a. m.	28 9	9 3	2 2	S. W.	3 fair -	0,296
	4 p. m.	28 8	9 5	2 0	S. W.	2 fair	
25	9 a. m.	28 9	9 2	2 4	W.	2 fair -	0,100
	5 p. m.	29 2	9 2	1 8	W.	2 fair	
26	9 a. m.	29 4	9 5	2 2	W.	2 fair	
	5 p. m.	29 4	10 8	1 7	S. W.	2 fair	
27	9 a. m.	29 0	10 3	2 5	S. E.	2 drizzling	
	5 p. m.	28 9	10 9	1 8	S. W.	2 fair	
28	9 a. m.	29 1	10 6	2 1	S.	2 cloudy -	0,295
	6 p. m.	29 2	10 6	1 9	S.	2 fair	

H: at a med. 29 7 9 0 2 1 Total Depth 3,507

Gr. Height 30 5 12 4 2 8

L. Height 28 8 7 4 1 7

M A R C H 1735.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29 2	10 4	2 1	S. W.	2 fair - -	0,180
	5 p. m.	29 1	10 5	2 0	N. W.	2 cloudy	
2	9 a. m.	29 0	10 0	2 2	S. b. W.	2 fair -	
	5 p. m.	29 1	10 6	2 6	S. E.	2 cloudy	
3	9 a. m.	29 2	9 8	2 5	S.	2 cloudy -	0,050
	5 p. m.	29 1	10 4	2 2	W.	2 cloudy	
4	9 a. m.	29 2	9 8	2 2	S.	2 fair	
	5 p. m.	29 2	10 2	2 2	S.	1 cloudy	
5	9 a. m.	29 4	11 0	2 3	S. W.	2 fair	
	6 p. m.	29 5	11 3	2 0	S. W.	2 cloudy	
6	9 a. m.	29 5	11 0	2 2	W. b. N.	2 fair	
	5 p. m.	29 7	11 0	2 0	N. W.	2 fair	
7	9 a. m.	30 0	9 2	2 1	S. W.	2 fair	
	4 p. m.	30 1	10 7	2 1	E.	2 fair	
8	9 a. m.	30 1	9 8	3 0	S. E.	2 Fog	
	4 p. m.	30 1	10 6	2 8	S. E.	2 Fog	
9	9 a. m.	30 2	9 7	3 6	S. E.	2 Fog -	0,190
	6 p. m.	30 2	10 1	3 3	S. E.	2 Fog	
10	9 a. m.	30 1	9 6	3 4	S. E.	2 Fog -	0,170
	6 p. m.	30 0	9 9	3 0	S. E.	2 Fog	
11	9 a. m.	29 9	9 0	3 0	N. E.	3 cloudy	
	5 p. m.	29 9	9 7	2 0	N. E.	3 fair	
12	9 a. m.	29 9	9 5	2 0	E.	1 Fog	
	6 p. m.	29 8	10 4	1 8	E.	1 Fog	
13	9 a. m.	29 7	9 6	1 9	S. E.	1 fair	
	5 p. m.	29 6	10 0	1 8	S. E.	1 fair	
14	9 a. m.	29 4	8 6	2 0	S. E.	2 fair -	0,290
	5 p. m.	29 3	10 5	1 8	S. E.	2 fair	
15	9 a. m.	29 2	9 3	1 2	S. E.	2 fair	
	5 p. m.	29 1	9 9	2 5	E.	2 cloudy	
16	9 a. m.	29 0	9 6	3 8	E.	3 Rain	

0,880

M A R C H 1735.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.	Weather.	Rain.
		In. D.	In. D.	In. D.	Dir. For.		
17	9 a. m.	29 4	8 7	2 8	N. E.	3 cloudy	0,880
	5 p. m.	29 5	9 3	2 2	N. E.	3 Hail	
18	9 a. m.	29 7	8 5	2 2	N. E.	2 fair - -	0,450
	5 p. m.	29 8	9 3	1 9	W.	2 fair	
19	9 a. m.	29 8	9 4	2 0	N. W.	2 fair - -	0,270
	4 p. m.	29 8	9 6	1 8	N. W.	2 fair	
20	9 a. m.	30 0	8 5	2 3	N.	2 fair - -	0,165
	5 p. m.	30 0	9 8	2 0	N.	2 cloudy	
21	9 a. m.	30 1	9 3	2 1	W.	2 cloudy	
	5 p. m.	30 1	10 7	2 1	W.	2 fair	
22	9 a. m.	29 7	10 4	2 5	W.	2 Rain	
	5 p. m.	29 6	11 5	2 7	W.	2 drizzling	
23	9 a. m.	29 6	11 5	3 2	W.	2 cloudy -	0,450
	5 p. m.	29 6	11 9	2 5	W.	2 Rain	
24	9 a. m.	29 4	11 4	2 8	N. W.	2 Rain	
	6 p. m.	29 3	10 3	3 1	N. W.	2 Rain	
25	9 a. m.	29 3	9 8	2 7	N. E.	2 cloudy	
	5 p. m.	29 2	9 9	2 2	N. E.	2 fair	
26	9 a. m.	29 1	10 0	2 5	N. E.	2 cloudy -	0,390
	5 p. m.	29 1	9 0	3 1	N. W.	2 Rain	
27	9 a. m.	29 3	9 6	3 0	W.	2 fair - -	0,910
	5 p. m.	29 3	10 7	2 3	N. E.	2 fair	
28	9 a. m.	29 3	9 9	3 5	N. E.	2 Rain - -	0,060
	6 p. m.	29 3	9 7	4 0	N. E.	3 Rain	
29	9 a. m.	29 2	10 0	3 3	N. W.	2 cloudy -	0,970
	5 p. m.	29 4	9 8	2 4	N. W.	2 fair	
30	9 a. m.	29 6	9 5	2 3	W.	2 fair - -	0,640
	6 p. m.	29 5	10 9	1 9	S.	1 cloudy	
31	9 a. m.	29 3	9 4	2 4	W.	1 cloudy -	0,190
	6 p. m.	29 4	10 8	2 0	W.	1 fair	
H. at a med	29 3	9 9	2 4			Total Depth	5,375
Gr. Height	30 2	11 9	4 0				
L. Height	29 0	8 5	1 2				

APRIL 1735.

D.	Hour.	B:ro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29 5	10 2	2 3	W.	2 fair	
	6 p. m.	29 6	11 7	1 9	N. E.	2 cloudy	
2	9 a. m.	29 7	11 8	2 0	S.	1 fair -	0,085
	5 p. m.	29 8	13 3	1 9	S.	1 fair	
3	9 a. m.	30 0	12 3	2 3	S. E.	2 fair -	0,070
	5 p. m.	30 0	13 0	1 7	S. E.	2 fair	
4	9 a. m.	30 1	10 7	2 4	S. E.	2 cloudy -	0,190
	6 p. m.	30 1	10 5	2 1	E.	2 fair	
5	9 a. m.	30 1	10 3	2 9	E.	2 cloudy	
	6 p. m.	30 1	9 8	2 7	E.	2 cloudy	
6	9 a. m.	30 0	9 7	3 0	E.	2 Rain -	0,250
	6 p. m.	30 0	10 1	3 2	E.	2 drizzling	
7	9 a. m.	29 9	10 0	3 4	E.	2 Fog -	0,060
	6 p. m.	29 8	10 1	3 3	E.	2 Fog	
8	9 a. m.	29 7	10 5	3 2	E.	2 Rain	
	7 p. m.	29 6	10 8	2 9	E.	1 cloudy	
9	9 a. m.	29 4	11 6	2 9	E.	1 fair	
	6 p. m.	29 4	12 1	2 1	S.	1 cloudy	
10	9 a. m.	29 4	10 8	2 9	E.	2 cloudy	
	7 p. m.	29 3	10 2	4 1	E.	2 Fog	
11	9 a. m.	29 2	10 8	4 1	E. b. N.	2 Fog	
	6 p. m.	29 3	10 5	4 1	E. b. N.	2 Fog	
12	9 a. m.	29 4	11 9	3 9	S. W.	0 cloudy -	0,140
	6 p. m.	29 5	11 5	3 1	W.	1 cloudy	
13	9 a. m.	29 7	11 4	2 7	W.	2 fair -	0,050
	7 p. m.	29 8	11 7	2 4	W.	2 fair	
14	9 a. m.	29 8	12 1	2 6	S. ?	0 cloudy	
	6 p. m.	29 6	12 7	2 5	S.	2 cloudy	
15	9 a. m.	29 6	12 0	2 5	W. b. S.	2 cloudy	
	6 p. m.	30 0	13 0	1 7	W.	2 fair	
16	9 a. m.	30 0	11 4	2 0	W.	2 fair	
	6 p. m.	30 0	13 0	1 7	W.	2 fair	

0,845

A P R I L 1735.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	29 7	12 9	2 1	S. b. E.	1 fair	0,845
	7 p. m.	29 6	12 5	2 0	S.	2 cloudy	
18	9 a. m.	29 6	11 9	2 0	S. W.	3 cloudy	
	6 p. m.	29 7	11 5	1 9	S. W.	2 cloudy	
19	9 a. m.	29 4	11 5	1 9	S. W.	3 cloudy -	0,110
20	9 a. m.	29 5	11 3	2 9	W.	3 cloudy -	0,036
	7 p. m.	29 4	11 7	2 0	W.	2 cloudy	
21	9 a. m.	29 2	11 8	2 4	W.	4 fair	
	7 p. m.	29 3	11 4	1 8	W.	3 fair	
22	9 a. m.	29 0	11 9	2 0	W.	3 cloudy	
	7 p. m.	29 0	11 2	2 0	W. b. N.	3 cloudy	
23	9 a. m.	29 5	11 1	1 8	W. b. N.	2 fair	
	6 p. m.	29 6	12 1	1 7	W. b. N.	2 cloudy	
24	9 a. m.	29 7	13 1	1 9	S. W.	2 cloudy	
	7 p. m.	29 6	12 5	1 8	S. W.	2 cloudy	
25	9 a. m.	29 5	12 6	1 8	S. W.	2 fair -	0,070
	7 p. m.	29 5	13 5	1 5	S. W.	1 fair	
26	9 a. m.	29 6	12 8	1 7	S. W.	1 fair -	0,290
	6 p. m.	29 5	13 4	1 5	S. W.	2 fair	
27	9 a. m.	29 3	11 4	2 0	N. E.	2 Rain --	0,090
	7 p. m.	29 3	10 8	2 7	N. E.	2 Fog	
28	9 a. m.	29 2	11 7	2 0	N. W.	2 cloudy	
	7 p. m.	29 3	12 0	1 9	N. W.	3 fair	
29	9 a. m.	29 5	11 6	1 9	S. W.	2 fair	
	7 p. m.	29 6	12 8	1 6	S. b. E.	1 fair	
30	9 a. m.	29 8	11 5	2 1	E. b. S.	2 fair -	0,195
	6 p. m.	29 8	12 5	1 8	E.	2 fair	

H. at a med. 29 7 11 2 2 3 Total Depth 1,630

Gr. Height 30 1 13 5 4 1

L. Height 29 0 9 7 1 5

M A Y 1735.

D.	Hour.	Baro.	Ther.	Hyg	Wind.	Weather.	Rain..
		In D.	In. D.	I. D.	Dir. For.		In.D..
1	9 a. m.	29	9	12	7 I 9	S. W.	2 cloudy -
	8 p. m.	29	7	11	7 I 9	S. W.	2 cloudy
2	9 a. m.	29	7	12	0 I 9	W. b. N.	2 fair
	8 p. m.	29	7	11	2 I 6	W. b. N.	2 fair
3	9 a. m.	29	6	11	4 I 6	W. b. N.	2 fair
	7 p. m.	29	7	12	8 I 5	W. b. N.	2 fair
4	9 a. m.	29	9	11	7 I 5	N.	2 cloudy
	8 p. m.	29	9	11	6 I 5	N. E.	1 cloudy -
5	9 a. m.	29	9	12	0 I 6	N. E.	2 fair
	7 p. m.	29	9	11	7 I 5	N. E.	2 fair
6	9 a. m.	29	9	12	3 I 5	W. b. N.	2 fair
	5 p. m.	29	9	13	6 I 5	W.	2 fair
	7 p. m.	29	9	12	5 I 7	N. W.	2 cloudy
7	9 a. m.	30	0	12	5 I 5	N. W.	2 fair
	7 p. m.	30	0	11	6 I 6	N. W.	2 fair
8	9 a. m.	30	0	12	8 I 9	S. W.	3 cloudy
	7 p. m.	30	0	12	7 I 6	W.	3 fair
9	9 a. m.	30	0	13	2 2 0	W.	4 cloudy -
	8 p. m.	29	9	11	8 I 5	W.	3 fair
10	9 a. m.	29	9	12	3 I 3	N. W.	3 fair
	8 p. m.	29	9	11	0 I 3	N. W.	3 fair
11	9 a. m.	29	7	10	9 I 3	N. W.	3 fair
	7 p. m.	29	5	9	5 I 9	N. W.	3 Rain
12	9 a. m.	29	5	10	8 I 7	N. W.	2 cloudy
	7 p. m.	29	6	10	2 I 4	N. W.	2 cloudy
13	9 a. m.	29	6	11	7 I 2	N. W.	2 cloudy -
	8 p. m.	29	7	10	6 I 2	N. W.	2 fair
14	9 a. m.	29	6	11	6 I 4	N. W.	2 fair - -
	8 p. m.	29	5	11	5 I 3	N. W.	1 cloudy
15	9 a. m.	29	3	10	7 I 5	S. W.	3 fair
	7 p. m.	29	2	11	2 I 1	S. W.	3 fair
16	9 a. m.	29	4	11	6 I 4	W. b. S.	2 cloudy
	7 p. m.	29	4	12	5 I 2	W. b. S.	2 cloudy

0,3655

M A Y 1735.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.	Weather.	Rain,
		In. D.	In. D.	I. D.	Dir. For.		
17	9 a. m.	29 5	12 1	1 1	W.	2 fair	0,365
	7 p. m.	29 7	12 9	1 2	W.	2 fair	
18	9 a. m.	30 1	12 2	1 0	N. W.	2 fair - -	0,150
	7 p. m.	30 1	13 7	0 9	N. W.	1 fair	
19	9 a. m.	30 2	13 5	1 2	W.	2 cloudy	
	8 p. m.	30 2	14 3	1 0	S. W.	2 cloudy	
20	9 a. m.	30 0	13 7	1 4	S. W.	2 cloudy	
	8 p. m.	29 8	12 9	1 2	W.	2 fair	
21	9 a. m.	29 8	13 7	1 4	N. W.	2 fair	
	8 p. m.	29 8	12 5	1 3	N. W.	2 cloudy	
22	9 a. m.	29 6	11 9	1 6	N.	2 Rain	
	8 p. m.	29 7	12 6	1 8	N.	2 cloudy	
23	9 a. m.	29 9	11 0	2 0	N.	2 cloudy	
	7 p. m.	29 9	11 1	2 0	E. b. N.	2 Rain	
24	9 a. m.	29 9	11 1	2 0	N. E.	2 cloudy	
	8 p. m.	29 9	12 4	1 5	N. E.	2 fair	
25	9 a. m.	29 8	12 3	1 9	N. E.	1 cloudy	
26	9 a. m.	29 9	11 3	3 3	N. E.	2 Fog - -	0,100
	8 p. m.	29 9	11 0	2 1	N. E.	2 Rain	
27	9 a. m.	30 0	11 0	2 3	N. E.	2 fair	
	8 p. m.	30 1	11 9	2 3	N. E.	2 fair	
28	9 a. m.	30 2	12 2	2 2	E. b. N.	2 fair	
	8 p. m.	30 1	13 6	1 9	E. b. N.	1 fair	
29	9 a. m.	30 1	13 4	1 3	S. E.	1 fair - -	0,070
	8 p. m.	30 0	14 7	1 5	S. E.	2 fair	
30	9 a. m.	29 9	13 5	1 8	E.	2 cloudy	
	8 p. m.	29 8	14 1	1 6	E. b. N.	2 fair	
31	9 a. m.	29 7	12 4	2 5	E.	2 cloudy -	0,035
	8 p. m.	29 7	13 4	2 0	N. E.	1 fair	
<hr/>							
H. at a med.	29	8	12	1 1	6	Total Depth 0,720	
<hr/>							
Gr. Height	30	2	14	7 3	3		
<hr/>							
L. Height	29	2	9	5 0	9		

II. An Account of the DISEASES that were most frequent last Year in Edinburgh.

THE Tertian Ague, which we already mentioned to have begun in March 1734, continued till the warm Weather in June thereafter put an End to it.

In MAY, JUNE and JULY 1734, several Children in the Neighbourhood of Edinburgh, and some within the City, laboured under the *Tussis convulsiva*, Hooping-cough, or Kink-cough. In AUGUST more Children were attacked by it. It became more frequent in SEPTEMBER. In OCTOBER few Children in the Villages near Edinburgh escaped it, and it was frequent all Winter within the Town, several Adults being also seized with it. The Symptoms of the Sick were no other than what commonly attend this Disease.

The Method of Cure most commonly followed here was, to keep the Vessels empty enough, by the Evacuations of bleeding, vomiting, purging and Blisters, which did not seem so much to shorten the Disease, as to prevent its proving fatal; for notwithstanding the liberal Use of these Evacuations, the Disease frequently continued several Months: For most part however there was a sensible Remission for some Days after bleeding or purging, especially when the Purgatives worked upwards too. Pectorals of the soft balsamick kind, and the most attenuant were also given, but with little or no good Effect. Opiates rather did hurt. A great many Specificks were likewise employed, but, so far

as we could observe, with as little Success, as the numerous Charms the good Women thought fit to make Use of.

Other *Coughs* were also rife, and difficult to remove through the Winter.

It is worthy of a Remark, that both common and convulsive Cough, after being milder in *January 1735*, suddenly became much worse in the first Week of *February*, and continued so the greater Part of that Month, gradually decreasing afterwards as the Spring and Summer advanced.

Rheumatick Pains and *Stitches*, some with, others without Fever, seemed to begin, continue and decrease with the Cough. Repeated *Bloodings* and *antiphlogistick Purgatives*, with diluent, cooling, attenuant Medicines, proved the most effectual Remedies.

Towards the End of *SEPTEMBER*, and in *OCTOBER*, many People were seized with a *Dysentery*, of which there were some Remains in this Place all Winter. It had the ordinary Symptoms of slight Fever, frequent Stools, for most part bloody and mucous, violent Gripe, and an almost constant *Tenesmus*.

This Disease was fatal to some, and very tedious in others, who neglected the Evacuations in the Beginning, and had too soon Recourse to Opiates and Astringents.

Patients under the *Dysentery* were generally bled, vomited with *Ipecacuanna*, and purged with *Rhubarb*, with Opiates sometimes in the Intervals, and mild mucinous Food and Drink. In some Cases, where the ordinary

Method failed, the *Vitrum Antimonii ceratum* was given with Success.

In OCTOBER there were some Fevers of a bad kind, in which the Head was much affected, and the Pulse low and sunk. Such Sick could not bear bleeding, and Blisters did very little Service to them.

In FEBRUARY Agues began, increased in MARCH and APRIL, and then gradually went off; and at the same Time some remitting Fevers were observed.

In the End of *March*, and Beginning of *April* many Children were seized with a very irregular Fever, which seldom continued any Number of Hours in the same Way. They were sometimes hot, then turned cold. Their Pulse was now very quick, soon after became moderate. Sometimes they had difficult Breathing, Thirst, Purging, like the *Diarrhœa* in Teething; at other Times they were free of these Symptoms. Notwithstanding any Medicines that were given, the Disease continued about ten Days, and then terminated in a Cough, which remained some Time with most of them, and in others was very difficult to remove.

III. An Extract from the publick Register of Burials in Edinburgh.

	Men.	Women.	Child.	Still-born.	Sum.
June - -	10	25	28	5	68
July - -	18	18	22	9	67
August -	18	21	39	4	82
September	18	21	34	6	79
October -	28	34	39	4	105
November	24	35	41	5	105
December	27	36	51	4	118
1735.					
January -	25	38	48	4	115
February -	21	18	53	5	97
March -	25	37	61	6	129
April -	17	21	53	3	94
May -	13	29	46	2	90
Total	244	333	515	57	1149

IV. The good Success of opposite Causticks, and of a strong alterative Mercurial Medicine; by Dr. EDWARD BARRY Physician at Cork, and F. R. S.

I Visited with Mr. Osburne and Mr. Wilson, two eminent Surgeons in this Place, a Gentleman of about forty five Years of Age, of a sober Life, and in a married State, who had a hard Tumor formed in the Coats of the *Testes*, which lightly adhered to the right Testicle, and extended to the *Epididymis*, and was then as large as a Turkey-egg. It came on him without any Cause which he could account for, and was equal to the Size of a Walnut when he first perceived it. He says it made this Progress in the Space of one Night.

Some Months before he came to Town, E-
C 3 mollients

mollients and Suppuratives were used, a Collection of *Pus* was suspected, and a Puncture made, a small Discharge of Blood and Ichor followed, the Tumor continued large and schirrous, with the Appearance of a cancerous Ulcer.

Various internal Medicines, and external Applications were made use of to no Purpose; but the following Method removed this Disorder.

The common *Caustick*, which is named by some *Lapis Septicus*, and by others, *Lapis infernalis*, was applied; after the Separation of the Eschar, about two Inches in Length, the *Lapis infernalis* and *Oleum Vitrioli* were alternately used, by rubbing the Part first with the *Lapis infernalis*, and, in less than a Minute afterwards, with a Piece of Fir-stick dipped in the *Oleum Vitrioli*, which instantly removed the Pain occasioned by the *Lapis infernalis*. At each Dressing this alternate Application of these opposite Causticks was repeated, till as much was wasted as was then thought convenient; the Moisture was absorbed by an armed Probe, and a Digestive applied.

By these Means the Tumor was gradually wasted every Day, without any continuing Pain or succeeding Inflammation; a small Part was suffered to remain adhering to the Testicle. This was thought more prudent than to run the Hazard of injuring the Testicle. This Application answered lately in another very obstinate schirrous Tumor in the Coats of the *Testes*, and in many Cases seems to be preferable to common Causticks; the one correcting by its opposite Quality the too active Salts of

the

the other, and by that means instantly removing Pain, and by producing a *Sal Tertium*, which has a mild opening Quality, prevents an Inflammation and callous Lips, the common Consequences of caustick Applications.

About three Months afterwards a Tumor appeared in the other Testicle of this Gentleman, of about the Size of a Walnut, which was removed, by giving him going to Bed at Night 15 Grains of *Pil ex duobus*, 10 Grains of *Turbit Mineral*, and the same Quantity of *Camphire*. It was seldom omitted any Night. In the Beginning it vomited him some times, and purged four or five times; but at last operated chiefly as an Alterative, and in three Weeks not only carried off this Tumor, but entirely removed the small Swelling that was left on the other Testicle. This Medicine, which has a rough Appearance, acts as a mild, though a powerful Alterative. The Evacuation which attends it, is generally very gentle. I have often known it successful in obstinate venereal and scrophulous Disorders. Mr. *Moore*, a Surgeon in the Army, to whom I communicated it some Years ago, assures me it never fails him in obstinate *Gonorrhœas*, and in many Cases for which he was formerly obliged to direct a Salivation.

V. An Essay towards ascertaining the Doses of vomiting and purging Medicines; by Dr. CHARLES BALGUY Physician at Peterborough.

After finding out a Disease, and prescribing such Medicines as shall answer the true Indications of Cure; there is nothing in Practice more material, and yet less understood, than the Art of adjusting their Doses so nicely to the Case in hand, and to the Age, Size and Strength of the Person, that he shall receive the most speedy and certain Relief these Medicines are capable of giving, without the Hazard of burdening Nature, and overdoing the Constitution. Dr. Cockburn attempted this some time since, in vomiting and purging Medicines; but as he went upon a wrong Principle, he must needs be mistaken in his Consequences. Perhaps what I'm going to advance may be liable to Objections; I know it is, and I shall show that an absolute Certainty cannot be expected: But yet I think I may venture to say, that you go upon surer Grounds by following this Method, imperfect as it is, than no Method at all. First then, I suppose it will be readily granted me, that part of the Medicine is spent on the *prime viæ*, where it acts as a *Stimulus*; and that the other part is carried into the Blood, and has its Effect there, by thinning and rarifying it: The first is plain, from their acrid burning Taste, and the Blisters which the most powerful will raise in the Mouth: The other is certain, from the Pulse being raised after taking them, and from

from known Experiments upon the Blood: But in what Proportion they exert their different Faculties is the Difficulty; could this be precisely determined, the Doses of these Medicines might be fixed with the utmost Exactness and Certainty. All that can be done then is, to assign such a Proportion as seems most agreeable to Experience. Thus we all know, that resinous Purges exert themselves chiefly on the first Passages; whereas the greatest part of such as are of a more lax Texture is carried into the Blood, and by attenuating it, promotes every other Secretion, as well as that by the Intestines. It may seem reasonable therefore to suppose, that of *Scammony*, *Elaterium*, and the strongest resinous Purges, not more than one fourth gets into the Blood: Of *Jalap*, *Ipecacuanna*, &c. one third: Of Rhubarb, Senna, Aloes, &c. one half, Of *Cremor Tartari*, and the purging Salts two thirds. This being allowed, I proceed in the following Manner: And 1st, I say, If the Medicine acted only on the *primæ viae*, the Dose, in Persons of the same Size, would be directly as the Constitution; for as the Fibres of the rest of the Body, so are those which compose the Stomach and Intestines; and the stronger they are, so much the more able will they be to shake off, and disengage themselves from the Particles of the Medicine, which are supposed to prick and irritate them: And therefore so much the larger Dose will be required to have a certain Effect. Where the Constitution is the same, it is easy to see that the Dose will be as the Size; when both differ, then it follows, that the Dose will be as the Size into the

the Constitution. 2dly, Suppose the whole Medicine to pass into the Blood; and the Dose will be as the Size into the Square of the Constitution. This is demonstrated by Dr. Cockburn; And therefore, 3dly, You are to dose so much of the Medicine as is spent on the Stomach and Intestines, directly as the Constitution; and so much as is carried into the Blood, as the Square of the Constitution, and the Sum into the Person's Size is the Quantity required. There are some Cases Exceptions to this Rule, which should be considered, and provided against: And first, in Constitutions which abound with Acids in the *primæ viæ*, we find the Force of resinous Purges so weakened, that they scarce operate at all. They are also less active, or a larger Dose is required, when the Body is full of aqueous Humours; for the small Proportion of Bile in such Constitutions not being sufficient to cause a complete Solution of the Resin in the Water, a considerable Part passes off, without imparting any of its Substance: As on the contrary, to Persons of a dry Habit, and in hot Climates and Seasons, they often cause intolerable Grippings and Hypercatharses, for want of due Moisture. But these, and others of the like sort, the Cause being known, are easily remedied. And though not attending to, or being unacquainted with the State of the Body in these particular Cases, may render this Method less useful, it is no less true on that Account.

VI. *The bad Effects of Opium given too soon to stop the Operation of Emeticks ; by Mr. JOHN STEDMAN Surgeon at Kinross.*

Notwithstanding all the Caution that can be used, *emetick Medicines* will sometimes do more than is intended they should, either by vomiting more frequently, or by purging. In such Cases the Patients become alarmed, frightened and impatient ; and those who have prescribed for them, either to humour their Patients, or perhaps too anxious about the Consequences, have Recourse immediately to *Opium*, to stop any further Effects of the Medicine. I know there is no such powerful and good Medicine as *Opium*, when properly given, to stop vomiting or purging : But I cannot forbear to caution young Practisers, not to be too hasty to give *Opium* in the Case mentioned, till the Emetick (and I may say the same of Purgatives) has wrought itself well out of the Body ; for I have seen several bad Consequences from its being used too soon, of which the following Case is a remarkable Example.

A Gentleman, aged forty nine, being troubled with a Cough, was prescribed 5 Grains of *Emetick Tartar* by his Physician : The Patient obliged his Apothecary to give him 6 ; which after vomiting him six or seven Times, began to purge him with Gripes. The Gentleman turned impatient ; and, without Advice, took 20 Gutts of *Laudanum* in a Glass of White Wine ; *Opium* having been a familiar Medicine for some Time, to remove a Watchfulness he was

was subject to. In half an Hour after taking the *Laudanum* he was free of the Grips and purging; but in half an Hour more became short-breathed, with Sweating about the Heart; then I was first sent for in a Hurry, but before any thing could be got done for his Relief, he died.

VII. *Pulvis Stypticus recommended particularly in uterine Hæmorrhagies; by Dr. ALEXANDER THOMSON Physician at Montrose.*

Scibonius Largus, the Roman Empyrick, made Use of simple *Allum* in the Evacuations of the Sex exceeding their due Bounds; and I have been told by Ladies, that it has very good Effects.

Helvetius improved on this, by adding *Sanguis Draconis*, whether as a *Larva*, to make it his own; or to prevent the Uneasiness of the Stomach, which he might suspect the *Allum* might give, I can't determine: But Dr. Pitcairn, whose Memory must continue as long as Physick is known, was the first who introduced the Use of it into this Country; at least, it was he who first desired me to make Experience of it in a Case which had resisted a great many other Medicines. Its Reputation kept up many Years, under the Name of *Pulvis Helvetii*, as an Astringent, especially in uterine Hæmorrhagies; and I see it inserted in the *Pharmacopœia* of your College of Physicians, by the Name of *Pulvis Stypticus*; though in some different Proportion, and different Manner of preparing, from what I have commonly used.

used. The Dispensatory Powder being prepared of a double Quantity of *Allum* to one of the *Gum*, and made into a Powder, without being put near to the Fire; whereas what I have used was equal Parts of both, the *Allum* being first melted in a Crucible, and the Powder of the *Sanguis Draconis* added to it, and then powdered together in a Mortar; possibly the Difference of their Effects may notwithstanding be very little.

The Use of both I think is now much laid aside, which I cannot but regrete; since I never found any Medicine (and I have tried several) so much to be depended on in all the *uterine Hæmorrhagies*; whether to correct the too frequent Return of the *Menses*, or their too great Abundance; to stop the *Flooding* which Women with Child are so subject to, or to moderate the Flow of too plentiful *Lochia*. I have tried it in so many Cases with Success, that it would be altogether tedious to give you their Histories.

The Quantity I give of the *Pulv. Helvetii* is more or less according to the Exigencies of the Patient: In violent Bloodings I give half a *Drachm* every half Hour, and seldom or never miss to stop it before three *Drachms* or half an Ounce is taken.

The Success of this Medicine in these bloody Evacuations has encouraged me to prescribe it also in the *Fluor albus*, that obstinate pernicious Disease of the Sex, in which I have been surprised at its good Effects.

VIII. *Violent Effects of a Mercurial Suffumigation ; by Mr. JAMES HILL Surgeon in Dumfries.*

A Tall gigantick Woman, sixty three Years of Age, complained to me of a Hoarseness and sore Throat, which she had laboured under some Months, owing, as she said, to a Cold ; but having observed some scabby Crusts on her Arms and Fore-head, I suspected her Disease to be venereal ; and at last was informed it was a *Lues* of four Years standing. Her other Symptoms were a weak low Pulse intermitting every third or fourth Stroke ; which she was sensible of, by a painful fluttering at her Heart, as she called it. She had so many Excrescences of every Sort about the *Pudenda*, she could neither sit nor walk without Pain. The *Cephalalgia* and other nocturnal Pains were so violent, that frequently she slept none all Night. By the long Continuance of her Disease, and the Bloodings and rough Medicines she had undergone, she was reduced almost to a Skeleton.

Her Case appeared desperate ; but the Woman begg'd so movingly for Relief, and Dr. Turner recommends his Method of *Cinnabarin Fumigations* in the very worst Circumstances so much, that I resolved to make Trial of their Effects.

On Monday 1st April 1734 at Nine a-clock of the Forenoon, I burnt half a Drachm of *faetitious Cinnabar* under her Nose and Mouth ; which she bore very well, sucking in the Fumes greedily,

greedily with little Cough. I left her wrapped up sweating and spitting. At Twelve she had spit half a Pound, was coughing a little, and the Room smelled pretty strong of a rising Salivation. Her Pulse was quicker and fuller, but very irregular and intermitting. She would not acknowledge herself to be sick, but said her Throat was easier. I ordered her to keep warm. At Three after Noon the Room smelled as strong as any I ever felt, when the Patient was spitting three or four Pounds a-day. She had had three Stools, was very sick, and complained of excessive Gripes. Her Pulse was quick, low, quivering and intermitting, I gave her 10 Drops of *Laudanum* in a Glass of a Cordial astringent Julep, put her into Bed with her Clothes on, and wrapped her up for sweating. At Nine in the Evening she was in a very profuse Sweat; her Pulse going at a high Career, full, strong, and intermitting only one Stroke of twenty one or twenty two. She told me she was altogether free of Sicknes, without any fluttering at her Heart. I left other 10 *Gutts* of *Laudanum* in a *Hau-stus*, to be given if the Gripes should return; which they did after Midnight, she having then exposed herself to Cold, by undressing to go naked to Bed. She had three Stools before the *Laudanum* had Effect, but grew easy again as soon as the Sweating returned.

In this Condition she continued all *Tuesday*, the Gripes, Sicknes and intermitting Pulse returning every ten or twelve Hours, and the profuse Sweat succeeding after taking the Opiat Draught.

On *Wednesday* Morning the Opiat was omit-

ted, and she had twenty Stools with the Sickness, Gripes and Intermission of the Pulse, by which she was much weakned. I again ordered the Opiat in a Glass of warm Claret, in the Afternoon ; which brought back the Sweat, and removed the other Symptoms ; and I gave her some *Ung. Citrinum* to anoint the Sores with.

She passed Thursday the same way as Tuesday, the fetid salivating Smell still continuing.

Friday Morning, at seven a-clock, she took a purging Potion, which did not operate at Nine, she lying and sweating. At Eleven I sent a *Stimulus*, to be taken if her Potion had then no Effect ; she concealed her having had three Stools, and swallowed the *Stimulus* : By which she was purged so severely, that at Six in the Evening she seem'd almost like one about to expire, but was soon relieved by her ordinary Anodyne, and lay perfectly easy all Night in a Sweat. By this Time her Throat was almost quite well, and all her other Stores were entirely healed.

Saturday Morning she had the Gripes, Sickness, and irregular Pulse ; notwithstanding this she walked that Day six or seven Miles, and rode one or two home, in wet cold Weather.

On Wednesday I was told she was no worse, the Purgings still continuing till the middle of May. Her Throat appearing a little tender, I gave her a Solution of *Calomel* in *Aq. Rosar.* to gargle with, desiring her to swallow none of it. This however purged her a little. Afterwards she took Dr. Plummer's Pills, with the *Sulphur aurat. Antim.* and *Calomel*, and drank

the

the Decoction of the Woods. With these she sweated plentifully in the warm Weather, but became free of all her former Complaints, riding about to Markets. When the cold Season came on, the Purging succeeded the Sweating now and then, till it went quite off in *February 1735*, when her Legs began to swell; of which she was relieved by two Doses of Purgatives. But the Swellings returning again, and she being neglected, they increased; she wasted, and at last died toward the End of *April*.

IX. *The Effects of a very small Quantity of Arsenick; by Dr. ALEXANDER THOMSON Physician at Montrose.*

A Lady finding some *Arsenick*, which she knew not, among other Things, for the Use of the Family, put a little of it into her Mouth, as People ordinarily do when they would discover Things by their Taste. Soon after, she came to know what it was; but being, as she thought, certain that she had swallowed none of it, would use no Precaution, and felt no Change on herself for twelve Hours. Then she became suddenly *vertiginous*; and being carried to Bed, her Body was all over convulsed, so as by her Motions the Bed and Chamber were shaken. I saw her four Hours after this Attack in this Condition; it was too late to give her a Vomit, neither did she complain of any Disorder in her Stomach or other Bowels. I gave her as much *Ol. Amygd. d.* as she could bear, and ordered an Injection of *Ol. Olivarium*; whereby hard *Faeces* of the Shape

and Figure of Sheeps Dung, and as deep-green a Colour as Cappers, were brought away. I repeated the Injections, till the Clyster came away as it was injected, without any of these Fæces.

The Convulsions and Frights in her Sleep, procured by *liquid Laudanum* given in Emulsions, still continued; and she awaked often with such Startings, that had not one in the Bed held her firmly, she would have been thrown out of it. In this Condition she remained a whole Day and Night.

The Day following, her Body, but especially her Head, Face and Neck, were all covered over with red Spots like *Measles*, with excessive Glowings and the *Aurium Tinnitus*. Her other Symptoms however began to abate.

To advance the Eruption, and thereby to carry off the internal Disease, I gave *Diascordium* and *volatile Medicines*, whereby she recovered of all the Symptoms from the Poison in five or six Days, but remained deprived of a fine Constitution several Years after.

X. Histories of Gangrenes cured by the Peruvian Bark; by several Hands.

THough the good Effects of Medicines are ascertained by a sufficient Number of well vouched Histories, Physicians and Surgeons must be cautious in giving, far more in depending on such as are recommended only by Report, or People whom they haue no Reason to confide in: We believe therefore it may be of Use to the Publick to collect here the Histories of

of the Service of the *Peruvian Bark* in *Gangrenes* from different Causes, which we have been favoured with from our Correspondents. We have taken the Liberty to abridge them, without, we hope, suppressing any thing that is material.

First Case, communicated to us by Mr. John Paisley Surgeon in Glasgow, was a Diary kept by Mr. John Hamilton Student in Physick and Surgery, of his Father's Disease, revised and approved by the ordinary Physician, Dr. George Thomson Physician in Glasgow.

Archibald Hamilton of Westburn Esq; aged seventy six, who had enjoyed uncommon good Health all his Life, having been scarce ever sick or out of Order, till he was seized with an *Hemiplegia* two or three Years ago, of which he recovered so well, by the Assistance of Dr. Thomson, that he walked abroad with the Help of a Staff, 10th April 1735, complained of a Pain in the Toe next to the little one of the right Foot; but neglected it two or three Days, till the Pain increasing, with an ouzing of Ichor from a small black Spot; and his Ankle swelling, some Tincture of *Myrrh* and *Aloes*, was applied to it.

On the 14th, the Swelling had gone a good Way up his Leg and the Spot was very black and dry. Antiseptick Fomentations and the Tincture were used. Notwithstanding which, and a Mixture of *Succus Cicutæ* and *Sp. Sat. Ammon.* with the Tincture, all the Symptoms increased next Day. The Doctor prescribed a Draught of the *Decoct. amar.* in which half a Drachm of the *Cortex Peruvianus* was boiled, to be taken every Morning.

Ths.

The Day following, viz. 17th, the Bone of the Toe appeared bare, the Flesh round it mortified, and black Spots were seen upon the Ankle and Calf of the Leg.

18th, The Toe was cut off at the second Joint; Digestive was applied, and the Leg was embrocated with *Sp. Anthos*, *Sal. Ammoniac.* and *Camphor*. All the Medicines being continued, there was no great Change for three Days.

On the 21st, the black Spots looked paler, but the Toes were all livid.

22d, His Pulse intermitted, and he was very uneasy.

23d, The Toes very black.

24th, The Sore very fetid. The black Spots in the Leg began to disappear.

25th, The Spots of a pale red Colour. A great Pain in the Sole.

No great Change on the 26th and 27th.

28th, The little Toe was cut off. Appearance of Suppuration, with violent Pain in the Sole of the Foot.

29th, The Patient slept none, was very feverish, and raved, with wild Looks. An emollient Pultice applied to the Sole.

30th, Still raved. The Swelling of the Leg almost entirely gone. No Spots on it.

1st May, Bloody finous Matter let out by an Incision in the Sole, where the Tendons were bared, and very tender.

2d and 3d, As formerly.

4th, The two remaining lesser Toes having mortified, were also taken off. The great Toe a little livid.

5th, The upper Part and Sole of his Foot ill.

ill-coloured. His Appetite now for the first Time failed him.

6th and 7th, Little Change.

8th, Fifteen Grains more *Cortex* added to each Draught.

9th, The Swelling in the Leg much diminished.

10th, The Ulcers in the Foot larger.

11th, As on the 10th.

12th, Towards Night he had frequent Faintings, an intermitting Pulse, great Oppression and Sicknes with Strugglings. Took *Sp. Lavend. compt.* and *Salin. aromat.*

13th, Much relieved, but still confused with wild Looks.

14th, He was calm and chearful, with a regular Pulse.

15th, The Swelling of the Leg being now gone, the spirituous Embrocation was laid aside.

16th, The Ulcer was cleaner. Half a Drachm more *Bark* was added to each Draught.

From this to the 26th of June, his Cure seemed to go on successfully, with his Dressings and Decoction.

26th June, The Foot began to swell with great Pain.

27th, The Swelling increased up the Leg; and the great Toe, which had been hitherto of a bluish Colour, became nearer to a black Colour. The Decoction was continued, and the spirituous Embrocation was again used.

The Swelling, with black Spots about the Ankle, increased up to his Knee before the 7th of July, when the Ulcer in his Foot was black.

Instead,

Instead of the *Decoët amar.* he was now ordered to take half a Drachm of the *Bark* in Substance, Morning and Evening.

8th July, Black Spots appeared above as well as below the Knee, one of them was two Inches in Diameter.

9th, The Swelling of his Foot less.

10th, His right Testicle also swelled.

Little Change till the 15th, only the Swelling of the Testicle abated.

15th, He would sit up. The Leg swelled greatly.

16th, Many small, livid, or pale red Spots above the Knee.

Till the 20th the Appearances all better; the Swelling diminishing; the Spots going off; the Ulcer digesting.

20th, He had got little Sleep, had great Pain; his Pulse was oppressed; and he very faintish: he took some cordial Drops, without any Relief. The Dose of his *Bark* was increased to two *Scuples*, Morning and Evening.

Next Day the Leg looked worse, but much better the two following Days.

24th, In the Night before, he had a great Sweat in the Thigh and Leg, and the Swelling was fallen two Inches.

The Cure went well on with the *Cortex*, without any new Symptom, till August 10th, when a small Tumor was observed near the Heel; the Matter from which discharging at the Ulcer in the Sole of the Foot; it was afterwards cured by Compression. The swelling of the Leg appearing now to be only oedematous, was bandaged up to the Knee.

In the Beginning of *October*, when the Sores seem'd to be near cured, he omitted the *Bark*; but a Blister as big as a Hen's Egg, rising on the great Toe of the left Foot; and, two Days after, such another appearing on the great Toe of the right Foot, he returned again to the Use of the *Bark*: The Skin, which they covered, is fresh and clean. The other Ulcers are now near healed; and we resolve to continue the *Bark* some time after the Cure, to prevent more Returns.

It is to be remarked, that during all the Time of the Cure, except when the Patient was sick and oppressed, he would not be confined to any *Regimen* in Diet, but indulged himself even in a plentiful Use of Salt Meats and strong Malt Liquors.

Obs. II. Mr. *William Wood* Surgeon in *Edinburgh* informs us, that a young Woman, who was brought very low both in Flesh and Strength, by what was judged an *Atrophy*, from Obstructions in the Mesentery, had her Feet greatly swelled in the oedematous way, as all the depending Parts of her Body, even in a lying Posture, also were; which shewed the *vis vitæ* to be very weak, and the small Remains of her Blood to be in a very watery State. The Skin on the superior Part of the right Foot having become black, with all the other Symptoms of Mortification; Dr. *Francis Pringle*, who had attended her in her former Disease, and Mr. *Monro* who was called upon this gangrenous Appearance, agreed with Mr. *Wood* in Opinion, that the mortified Foot should

should be well fomented with an antiseptick Decoction, that all the Gangrene should be scarified, and *Basilicon* with *Oil of Turpentine* applied in the Incisions, and a Cataplasm of *Theriac* put over all; and that she should immediately begin to take a *Scruple* of the Powder of the *Peruvian Bark* four times a-day. Three Days after, the mortified Parts began to separate from the sound. In two Days more, she neglected her Doses of the *Bark*; very soon after which, there was no more Appearance of any further Separation; and upon taking her Medicine, the Separation went on as formerly. Her former Disease killed her in few Weeks, without any further Progress, or new Attack of the Gangrene.

Obs. III. Dr. Thomas Simson, Professor of Medicine in the University of St. Andrews, sent us the following Observation.

John Daw, about fifty Years of Age, Servant to a Miller here, after being employed all Day in supplying Corn to the Mill in a Sieve, felt an Uneasiness near the Insertion of the Tendon of the *Flexor* of the last Joint of the Forefinger, where the Edge of the Sieve, in which he had carried the Grain, rested. The Joint being also a little swelled, he was advised by his Neighbours to apply some *White Lilly Root* to make it suppurate. After applying this eight Days, meeting me in the Street, he shewed me his Hand; the whole Finger and Part of the *Metacarp* were now swelled, and there was a small Opening at the second and third Joints of the Finger, out of which a serous dark-

dark-coloured Matter issued. I desired him to apply a warm Pultice of boiled Oatmeal, to let Blood, to take a *Mercurial Bolus* at Night; and some *Fallap*, for a Purgative, next Day.

Three Days after, the 20th *March 1736*, I was sent for to visit him. Ever since the Purgative, which had operated mildly, he had been feverish, and his Hand was much worse; the two Under-joints of the Finger being quite mortified, there was a large gangrenous Blister both on the back and fore-part of the *Metacarp* next to that Finger. A very considerable florid *erysipelous* Swelling, which pitted, when pressed, extended itself as far up as his Elbow; and there was a Tension and Fulness on his Arm and in the Arm-pit. I ordered the gan-gren'd Parts to be fomented with Spirit of Tur-pentine, and gave him half a Drachm of the *Pulv. Cortic. Peruv.* every fourth Hour.

Next Morning the Inflammation had made no further Progress, and in the Evening the Swelling and florid red Colour extended no higher than his Wrist; and even below that the Appearances were better, the Parts being more sensible, and the Suppuration beginning round the middle Joint of the Fore-finger. I continued his Medicine, and on the 24th there was a compleat Separation of the mortified Parts, the blistered Skin cast off, and there was an Ulcer penetrating from one Side to the other of the Articulation of the first Bone of the Fore-finger with the *Metacarpal*, from which a Liquor in Colour like to the Decoction of the Bark was evacuated.

The two mortified Joints were cut off; I
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continued the Use of the Bark eight Days longer, but diminished the Number of Doses. The Stump was gradually covered with Flesh ; and after a Tendon was cast out of the Ulcer in the *Metacarp*, all the Sore speedily cicatrized.

Obs. IV. Dr. *Simson* has also favoured us with another Example of the good Effects of the Bark, in a Case which he cannot determine to have been a Gangrene, because he did not see the Patient.

Mr. *Morton* an Apothecary in *Coventry* wrote to him, that he, Mr. *Morton*, had laboured more than a Year under a sore Throat, occasioned by a Spot at the Root of his Tongue no bigger than a Sixpence ; which had been judged unanimously to be cancerous, and for which he had undergone a Variety of Cures, prescribed by the best Physicians. His Description made Dr. *Simson* suspect it rather of the Nature of a Gangrene ; and as he had had Experience that the Bark would do no Harm in Cancers, he desired him to try that Medicine. After taking it some Time, Mr. *Morton* writes the Doctor, That, since using it, he had spit up a great deal of dead Filth from the Sore which was filled up, though still it was painful and hard about the Edges.

Obs. V. Mr. *Gibson*, Town's Professor of Midwifery and Surgeon of *Edinburgh*, favoured us with a remarkable Instance of the good Effects of the *Cortex* in *Gangrenes*.

Mr. *Alexander Bayne* Merchant in *White-horse Yard* near *Drury-Lane*, *London*, aged forty,

forty, of a gross scorbutick Habit, in mounting a vicious Horse on the 4th of June 1735, was thrown on the Pin of a Cart; by which a large penetrating Wound was made in the under Part of the *umbilic* Region, and somewhat towards the right Side, through which the *Omentum* did fall down four or five Inches, with its lower Edge lacerated. There was also a simple Fracture of the *Fibula* of his left Leg.

I attended him with two other Surgeons, and finding the Colour of the *Omentum* changed, by being exposed some time to the Air, I extracted a little more of it softly, and made the usual Ligature upon the sound Part, and then cut it off to within half an Inch of the Tying, allowing afterwards the Extremities of the Ligature to hang out of the Wound, till it should fall off by the Suppuration. I thought the *Omentum* drawn together with the Ligature would favour the Discharge of Blood or Matter, as well as the Tents which Authors enjoin in such Cases, without the Pain or Inflammation which these cause. The external Wound was dressed with Pledgits dipt in a warm Digestive, and supported with Compresses and Bandage, so tight as to prevent the *Prolapsus* of any of the other *Viscera*. The Fracture of the *Fibula* was easily reduced, and dressed in the ordinary Way. He was plentifully bled, and an emollient Clyster was injected.

Dr. John Jamieson was called to our Assistance, and attended him afterwards all the Time of the Cure.

The two following Days no extraordinary Symptom appearing, he was dressed as formerly.

On the 7th of June the Digestion was begun.

On the 8th there was a reasonable Discharge of laudable well digested *Pus*.

But on the 9th in the Morning we were informed he had had a restless Night, having drank much, yet making no particular Complaint: Though his Tongue was white, it was not parched, nor had he any considerable Heat or Degree of Fever on him now, or ever after. The Dressings, when taken away, were dry, and some more than two Inches round the Wound the Parts were livid and insensible. The Teguments were immediately scarified, and stup'd with a proper heating Fomentation. Pledgits dipp'd in warm Oil of Turpentine were applied to the Scarifications, and a Pultice of *Theriac*, moistned with Spirit of Wine, was laid over all, and half a Drachm of the *Pulvis Cortic. Peruvian.* was ordered to be given every fourth Hour, drinking a small Glass of old strong Claret after it.

In the Evening, the Mortification had made no further Progress, and we observed a kind of Dew on the Dressings, which were renewed as before; and the *Cortex* was regularly given through the Night, which he passed with more Ease than he had done the preceding one.

Next Day there was a plentiful Discharge from the Wound of excellent Matter, and an *Ichor* from the Scarifications.

The *Bark* was continued till the 14th, when not only the Discharge at the Wound continued good, but the Incisions yielded laudable *Pus*; and all our Fears were over.

On

On the 15th, the Fracture was dressed, and appeared in a good Way.

On the 16th he complained of a Sense of Cold in the Foot of the fractur'd Leg; which alarming us, we undid the Dressings, and found the Skin livid and cold as Ice, with gangrenous *Vesiculæ* here and there, which immediately were cut, and studded with a warm stimulating *Fotus*. The Wound in the Belly, which was dressed at the same Time, discharged only a small Quantity of a fetid bloody *Ichor*, the Colour of the Skin round it being much paler than usual; wherefore we, without Delay, had again Recourse to the Bark, which answered our Expectation so well, that at next Dressing we had well concocted Matter from the Wound, and the Foot had recovered its natural Heat and Colour next Morning. We determined therefore to continue the Use of this excellent and necessary Medicine for a considerable Time: And indeed we had Occasion oftner than once to observe how much we stood indebted to it in this Cure; for if at any Time of the first three Weeks, the Distance of Time between taking each Dose exceeded eight Hours, we were sure to find the Matter in less Quantity, and of a much worse Quality.

Our Patient was cured in five Weeks, and was desired to wear a posting Belt, with proper Compresses upon the Place where the Wound had been for some Time, till the Cicatrix was sufficiently hardened, that upon any violent Motion a *Hernia* might be prevented.

Obs. VI. Mr. James Calder junior, Surgeon
in

in Glasgow, writes us, That a Boy of twelve Years of Age, of a good Constitution, having, by jumping, violently strained the Articulation of the Foot, it swelled considerably; and a Prentice having applied a tight Bandage to it, before next Night, when Mr. Calder first saw it, the Inflammation was greatly increased, and black Spots appeared upon the Surface of the Skin. The Boy's Pulse was high and quick. He was blooded, and had Clysters given him; the Part was well fomented, Pultices and spirituous Medicines were applied, and it was at last scarified. After a Variety of the common Medicines had been used eight Days to no Purpose, the gangrenous Spots spreading and turning deeper, Mr. Calder gave his Patient a Scruple of the *Pulv. Cortic. Peruvian.* four times a-day; and in six Days after his first beginning to take this Medicine, the putrid Parts separated and cast off, and the Cure went on afterwards as that of a common mild Ulcer uses to do.

Obs. VII. Mr. Monro Professor of Anatomy informs us, from the Records of the Infirmary here, That, on the 13th Day of March 1735, Robert Biggins, a middle aged labouring Man was received as a Patient there. By a Fall he had broke both the Bones of the Leg, three Inches above the Articulation of the Foot. There was a large Wound on the anterior Part of the Fracture, and a violent Inflammation and Tension on the whole Leg, with a Mortification begun near the Wound. In which Situation

tuation it would not allow of the Extension necessary for a Reduction.

For the first four Days he was treated in the common Method for Gangrenes, by fomenting the whole Member, Scarifications and warm spirituous Applications to the gangren'd Parts: and emollient Pultices over all, with Bleeding and low Diet. The Tension yielded a little to these, but the Gangrene advanced.

On the 17th he was ordered to take thrice a-day the Bulk of a Nutmeg of an Electuary, composed of the Powder of *Cortex Peruvianus* and *Syrup. Cariophyl.* and to continue the former Applications.

18th, There was a remarkable Change for the better; but on the 19th the Fomentation being neglected, the Pain became more violent, and the Appearances worse.

The Bark and Fomentation being again used, the Appearances were all good; and the bad Symptoms decreasing daily, the Fracture was reduced on the 24th, and the Cure went afterwards on in the common Way.

Obs. VIII. Mr. John Douglas Surgeon in Edinburgh informs us, That — Porteous, a labouring Man at Lintoun, about twenty Years of Age, having fractured his Arm by a Fall from a Cart, had it bandaged up by some of his Neighbours, without reducing the Fracture. Thirteen Days after, Mr. Douglas's Advice was first asked, when a large Swelling and considerable Mortification were brought on the Part; his Pulse being felt at the Wrist of that Arm in a natural State, and there being little Tumor in the

the Hand, he advised the gangren'd Part to be scarified, and to give the Patient half a Drachm of the Powder of the *Bark* every three or four Hours. Ten Days after, when he was again called to him, the swelling of the Arm was fallen, and a great Share of the sphacelated Parts were separated; he then attempted the Reduction of the Bone, which he could not accomplish 'till he sawed off a little of the lower Piece of the fractur'd Bone, when he observed all the Parts which the Bones hid before were mortified, except the Artery and a small Share of the Teguments on the back Part of the Arm: He therefore performed the Amputation close by the Head of the *Os Humeri*, beyond which the Mortification extended a considerable way; so that he had great Difficulty in stitching the Artery, the corrupted Flesh always yielding as he passed his Needle. He was obliged to apply Bandages, and therefore could not scarify, nor use the common Medicines in such Cases, but was obliged to trust entirely to the *Bark*, which he ordered to be given as formerly. In few Days a good Suppuration came on, and the Patient cured easily, and is now in good Health.

We have heard of several more Cases of *Gangrenes*, both from internal and external Causes, where the *Bark* was given, every one of which was successful; but we think these, with the Histories published in Art. V. and VI of our *Third Volume*, are sufficient to convince the most incredulous how valuable a Discovery has been made by Mr. *Rushworth*, who was the first

first who employed the *Peruvian Bark* in *Gangrenes*. See p. 323. of Vol. II.

XI. *The Description and Uses of the Intestinum Duodenum*; by ALEXANDER MONRO Professor of Anatomy in the University of Edinburgh, and F. R. S.

ANATOMISTS having generally copied *Vesalius's* (a) Description and Picture of the *Intestinum Duodenum*, which appeared to me very faulty, I caused Mr. *Cooper* to draw that Intestine in its natural Situation several Years ago: Since that Time I have read two Authors, *Santorini* (b) and *Winslow* (c) who have described this Gut more accurately than *Vesalius*; but neither of them having given any Figure of the Parts, and my Description differing considerably from theirs, as will appear upon comparing them; I resolved to send you this Paper, that the exact Situation of this Intestine might be more generally known, by which many Phænomena in the animal Oeconomy and Diseases may be understood and explained.

From the *Pylorus*, which is raised upwards and backwards from the Stomach, the *Duodenum* descends obliquely to the right Side, with the anterior *Lamella* of the *Omentum* fixed to its inferior Part; and the little *Omentum*, proceeding from the opposite Part, to connect it to the Liver. After this, the *Duodenum* is involved for about an Inch and a half, in a
Doubling

(a) *De corp. hum. fabric.* lib. 5. cap. 4.

(b) *Observ. anat.* cap. 9. § 7.

(c) *Exposition anat. traité du bas ventre*, § 105, &c.

Doubling of the *Omentum*, and then enters into the Duplicature of the *Mesocolon*, where it can't be seen without dissecting away that fatty Membrane. It descends in this cellular Sheath, till it is almost contiguous to the great *Sac* of the *Colon*, which properly is the human *Cæcum*. In this Descent the *Colon* lies before it ; the biliary Duct, hepatic Artery and Nerve, *vena portarum*, and emulgent Vessels are behind it : The Liver, Gall-bladder and right Kidney are on its right Side, and the *Pancreas* is on the left. This Gut makes several Turns in this Progress ; for it is raised into a Convexity forwards, where it passes before the Vessels of the Liver. Immediately after, it bends backwards and to the right Side, till it approaches the right Kidney, and then turns forward, and a little to the left in its Course towards the great *Sac* of the *Colon*. The *Duodenum* then makes a considerable Curve to the left Side, where it is involved in a cellular Substance, which may be looked on as the common Root of the *Mesentery* and *Mesocolon*, through the Membrane of which it may be seen commonly, even in very fat Bodies, without any Dissection. In the concave left Side of this Curve, the thick Extremity of the *larger Pancreas* and the *little Pancreas* are lodged ; the superior mesenteric Artery and Vein coming through the Notch between the *larger* and *lesser Pancreas* hang loose before the Gut here ; and the *Ductus communis Cholidochus*, after passing behind the Gut a little higher, unites commonly with the pancreatic Duct, very little above the lowest Part of the Curve, and after passing obliquely through

the

the Coats of the Gut, the two Ducts open by one common Orifice in the posterior Part of the *Duodenum*. After the Curve just now described, the *Duodenum* is involved in the Root of the *Mesentery*, and mounts obliquely within it towards the left Side, with the *Vena Cava* behind it; and after a Course of about four Inches there, rises forwards, to acquire a proper *Mesentery*, or to commence *Jejunum*, the Membranes of the Root of the *Mesentery* seeming to make a Ring at which the Gut comes out, though they are really continued on the Intestine, and form its external membranous Coat.

That the *Duodenum* may be all exposed to View, without changing its natural Situation in a Body lying supine, it is necessary to cut through the *great Arch* of the *Colon* below the Bottom of the Stomach, and after turning the cut Extremity of the left Side over on the left short Ribs, to take hold of the other Extremity of the *Colon*; and having separated it with a Pair of Scissars from the Stomach and Liver, taking away with it as much of the *Omentum* and *Mesocolon* as obstruct the View of the *Duodenum* and *Pancreas*, to lay it likewise on the right Loin. When the *Colon* is removed, observe where the Roots of the *Mesentery* and *Mesocolon* cover the *Duodenum* so much as to prevent your seeing its Course; at such Places cut their Membranes with a very sharp Scalpel, directing the Incisions according to the Length of the Gut, and then cautiously separate the Membranes to each Side, till all the Intestine is in View. Lastly, draw the small Guts gently down, raise the Liver, and suspend the *Fundus*

of

of the Stomach as much as is necessary to allow a full View of the whole Course of the *Duodenum*.

Those who have ever dissected the human Body must be sensible how difficult it is to lay the *Duodenum* of an Adult all in View, without disturbing its Situation, and the Task of keeping all the Parts in the same fit Posture till a Painter delineates them, is still much greater: Therefore, though the preceeding Description is taken from the adult Body, I chused to lay the Body of a *Fœtus*, which I had preserved several Years in acidulated Spirit of Wine, before Mr. *Cooper*, to draw the Picture from, and afterwards I compared this Picture with several adult Bodies, to make sure of there being no essential Difference.

- In *Tab. I. Fig. 1.* are represented:
 - AA The *Liver*, larger proportionally than in the Adult, and raised so that its concave Side is in View.
 - B The *umbilical Vein* entring the Liver.
This Vein is commonly described and painted as passing to the *Vena portarum*, without sending off any Branches: But in all the human Fœtuses, or young Children which I have dissected, after their Vessels were injected, I always saw the umbilical Vein giving off Vessels to the Liver, in its Passage through it towards the *Vena Portarum*.
 - C The *Gall-bladder* full of Bile, of a more pyriform Shape than it is for ordinary in an adult.

D The

- D The *Stomach* distended with Air.
- E The Remains of the *Omentum*.
- FF The Extremities of the divided *Arch* of the *Colon* laid to each Side.
- G The *Pylorus* where the *Duodenum* begins, and the *little Omentum* connects it to the Liver. From this to H it is covered by the *Omentum*. Between H and I this Gut is lodged in the cellular Substance of the *Mesocolon*, thence to K it is covered by the common Root of the *Mesocolon* and *Mesentery*. It runs involved in the *Mesentery* to L, where there is an Appearance of a Ring ; but instead of being turned down afterwards, as here represented, because of the Guts being drawn so much down to have a full View of the *Duodenum*, this Gut makes the Curvature delineated in Fig. 2.
- M The *large Pancreas* with its Duct, which is more hid by the Stomach in an Adult.
- N The *little Pancreas* with its Duct.
- O The Meseraic Artery and Vein cut as they pass in the Niche between the *larger* and *lesser Pancreas*.
- P The *Ductus communis Cholidochus* appearing on the left Side of the Gut, where it is about to join the *Pancreatic*.
- Q The right Kidney.
- R The small Guts.

From the Description of the *Duodenum* it must appear, 1. That since it is involved in the cellular fatty Substance of the *Omentum*, *Mesocolon* and *Mesentery*, without having the firm

external Membrane braced upon it as the other Guts have; it must therefore more easily yield to any distending Force: And having the whole Substances thrown into the Stomach with the Bile and pancreatic Juice poured into it, it must receive more than any other Intestine; and then whatever enters it, must go out with some Difficulty, because its Extremity next to the Jejunum, is fixed in a Course almost perpendicular upwards. So that upon the whole, it is no Wonder that this Intestine is frequently found of so much larger Diameter than the other Guts, as to be called *Ventriculus Succi-
centuriatus* by several Authors.

2. The ascending Course of the Extremity of this Gut, and the Influx of the Bile and pancreatic Liquor into the most depending Part of it, where the Food must make the longest Stop, are wisely contrived, both for the more easy Influx of these Liquors, and for a sufficient Quantity of them being mixed with the Food, to perform well the necessary Offices for which they are designed in Digestion.

3. A pendulous Intestine here would, in our erect Posture, have drawn the Stomach out of its due Situation, and might have twisted or overstretched the bilary and pancreatic Ducts, so as to have stopped the Course of the Liquors in them; and therefore it is so firmly tied down in its whole Course, that it cannot change its Situation.

The *Duodenum* of Brutes is likewise placed in such a manner as to answer the same useful Purposes, though in many of them this Gut would appear to one who does not consider the different

different Postures and way of Life of Animals, to be situated in an opposite manner to the human Body. To shew how general this Contrivance is, I shall cursorily mention a few Examples.

Apes, whose Posture is for most part erect, or near so, have these Parts disposed in near the same Way that Man has.

In *Dogs*, *Cats*, *Cows*, *Sheep*, and most other Quadrupedes whose Posture is horizontal, the *Pylorus* and Beginning of the *Duodenum* are firmly connected to the Liver; after which a considerable Piece of Gut, with a Mesentery, hangs pendulous, and then the Gut is fastned to the Loins and Backbone; therefore the pendulous Part must be lowest in them. The biliary Duct opens into the *Duodenum* where it is tied to the Liver. The *Pancreas* is long, and lodged in the Mesentery along the pendulous Gut, and its Duct is near the Middle of that Gland.

Hens, *Ducks*, *Geese*, and other Fowls, whose Posture of Body is neither erect nor horizontal, but oblique, have the Beginning of the first small Gut well secured to the Liver, from which the Gut runs near to the *Podex*, and returns again to near the same Place where it began at, to be again tied to the Liver, all between these two Connections being pendulous. The *Pancreas* is fixed between these pendulous Parts, and its Ducts open into the Part of the Gut where it had returned back to the Liver, as the biliary Ducts also do, but with a Direction opposite to the Course of the Aliment in the Gut. After the Entry of these Ducts, the Intestine

runs a good Way along the concave Part of the Liver towards the membranous Diaphragm, being fixed to the Liver and to the Air-membrane which lines the *Abdomen*. At length the Gut makes a Curve to the right Side, and takes its Course towards the *Podex*.

In *Cod*, *Haddock*s, and such Fish, the *Cæcula*, which are esteemed analogous to the *Pancreas* of other Animals, surround the first Gut, soon after it comes from the Stomach, and then the Intestine is fastned to the Liver, where the biliary Ducts open into it.

I designedly here leave the Reader to follow out the same Contrivances in this comparative Anatomy as were mentioned in the human.

If then we consider what Quantities of different Substances enter the *Duodenum*, some of which have rough hard Parts, to rub violently on its Sides; others have sharp saline Particles, to prick and corrode; others are irritating rancid Oils; others, in their Digestion, generate great Quantities of distending Air; others, by their Moisture and watery Nature, are apt to relax the Fibres; others harden these Fibres too much: If, I say, we consider this, we need not be surprised that this Gut, the *Duodenum*, should be more subject to Maladies than any of the rest; especially that it has not such a firm Covering of an external Membrane, to assist it to resist the Forces overstretching its Fibres, as the other Guts have. And if the Gut itself suffers, how soon must it disturb many other Functions of the animal Oeconomy, by the Pressure it may make, when overstretched, upon so many large Vessels, Nerves and other Organs,

to

to which it is inseparably contiguous, or by communicating its Afflictions to those Parts which sympathize with it, by means of the common Origin of their Nerves, or by stopping the Influx of these two absolutely necessary Liquors, the Bile and pancreatick Juice.

Any tolerable Account of Diseases, from such Causes as I have just now mentioned, would lead me far beyond the Bounds of any Essay you could admit of; and therefore I shall do no more than with *Santorini* (a) recommend to Practisers, to have such in their View, when they treat Patients who labour under Diseases of the *Epigastric* or *Hypocondriac Regions*, that they may not confound such which have their Seat in this Gut with others which require very different Treatment. This is the more necessary, because Authors generally take little or no Notice of the *Duodenum* as the Seat or Cause of any particular Disease.

XII. *Miscellaneous Remarks on the Intestines;* by the same.

THE preceding Account of the *Duodenum* has called to my Remembrance some Remarks that are commonly neglected, which I think may be made on the other *Chylopoietic Viscera*. If you are of Opinion they deserve a Place in your Collection, you may tack them to the Description of the *Duodenum*.

The Intestines are generally described as being covered all over with an external membra-

(a) *Observ. anatom.* cap. 9. § 7.

nous Coat which is said to be derived from the *Peritonæum*. But it ought to be remarked, that a considerable Part of the Circumference of the human Intestines is not covered with such a Membrane: For the Mesentery being formed by the *Peritonæum* produced on each Side, and including a considerable Quantity of cellular Substance, in which much Fat is frequently contained, together with the numerous *Glandulæ vagæ*, the large mesenteric Arteries and Veins, and the Nerves and Lacteals, and the fatty cellular Substance being thick, till after the Membrane of each Side is continued some Way upon the Gut, all the Space there between the Membranes, which is always more than the Distance between the Insertion of the Arteries that rise on each Side of the Gut, that is, a Fourth at least of the Circumference of the Gut must have no such firm membranous Coat covering it; and therefore will more easily yield to any stretching Force, which may be of Use, in allowing the Guts to be more enlarged than otherwise they could be, without overstretching their Vessels.

It is in this Space between the Insertion of the Blood-vessels that the *longitudinal* Fibres of the Guts can be seen most distinctly and easily; because the cellular Substance is separated with little Trouble, or collapses so much, as not to hinder the View of the muscular Fibres under it: Whereas, in the Part of the Intestine opposite to the Mesentery, the external membranous Coat, whose Fibres are very like to those carnosus ones, adheres so firmly to them, that it cannot

cannot easily be distinguished or separated from them.

I need scarce observe, that the *circular Fibres* of the Guts are often so interlaced, that one can scarce trace the same muscular Fibre round the whole Gut.

It is now generally enough known, that all the Substance between the interior Side of the circular muscular Fibres of the Guts and the villous Coat, which used to be divided into the *vascular*, *nervous* and *glandular Coats*, can, by blowing into a Piece of Gut whose interior Side is turned out, be raised into a *tunica cellularis*, with numerous Vessels running every where through it, without any Fat in it, where however it would appear there is some Secretion performed; for, by injecting Water into the Arteries, these Cells are filled with it; and frequently, after making Injections of grosser coloured Liquors, I see a Secretion performed, by the Cells being here and there distended with the white injected Substance, while the colouring Powder does not pass with it, but is left behind. When this secreted Liquor hardens, it forms a Number of small round or oblong Tuberles, which I have seen several willing to imagine were *Peyer's Glands* filled with the Injection; and this *Ruyfch* (a) seemed likewise to think. I can't yet bring myself to that Opinion, because Water diffuses itself so equally every where, and the Injections which harden do frequently the same for a large Space; at least, these make it evident, that if *Peyer's Glands*

(a) Epistol. 11. respons. & sparsim.

Glands are sometimes injected, there are also Vessels which convey Liquors into this *internal cellular Membrane*, which may lead us into a more reasonable Account of the very great Discharges of Mucus after an Excoriation of the Guts, and of the large extended hard Tubercles that are frequently seen within their muscular Coats, and of several other Phænomena of Diseases, than otherwise we could give.

In a Piece of Gut distended with Air in the Manner mentioned for demonstrating its *internal cellular Coat*, we see the *villous Coat* in its membranous Form, and without the downy, papillous and mamillary Appearance which an inverted undistended Intestine floating in Water has.

Upon observing this *villous Membrane* when it is stretched, remarking how thin and flexible the *Cuticula* becomes upon the Lips, with the Continuation of the same Membrane in the Mouth, Tongue, *Fauces*, *Oesophagus*, Stomach, and intestinal Canal; and upon comparing the Properties which the most external common Covering of the Body has, with those of this *villous Membrane*, we must be convinced they are very much of the same Kind, if not the same continued Substance. I do not know that all the Properties of the *Cuticle* have been considered by the Authors who describe it, far less, that a Comparison has been made between it and any of the internal Membranes, to shew their analogous Uses and Advantages, therefore beg to be allowed to consider them a little in this Way.

The *Cuticula* is notourly pervious to Liquors going

going out of the Body, and to others coming into it, so is the *villous Coat* of the Intestines, and both of them have other Passages through them, whereby they allow certain Substances to penetrate to the Nerves which they cover. Thus a Numness is brought on the Skin, by immersing any Part of the Body in several sorts of Liquors, and Pain is raised by Substances which do not destroy the *Cuticle*; thus sapid Objects affect our Tongue, and the different Sensations arise which we frequently feel from the Contents of the Stomach and Intestines.

The external *Epidermis*, by being exposed to a Variety of different Forces acting upon it, is of very different Thickness and Firmness in several Parts; but it is naturally formed so flexible, as to allow a sufficient Impression of tangible Objects on the Nerves below it. The internal Membrane of the Guts is less exposed to a Variety of such Causes, and therefore is more uniform; but can be changed in the same Manner by like Causes: And hence frequently we find the interior Surface of the Stomach and Guts of a callous Hardnes, and almost insensible, while for ordinary it is very sensible, and so flexible, that by being connected to such a loose cellular Substance as already described, it hangs floating, and assumes any Shape the contractile Fibres of these Cells give it, whether of large *Rugæ*, called *Valves*, or of smaller *Papillæ* of different Forms.

Thin watery saline Liquors wash away the *Cuticula*; thick mucinous Substances protect it against them, and the bad Effects of Friction: Therefore, where-ever the *Cuticula* is exposed

exposed to such Injuries, its Defence is likewise provided. Thus the *Eye-lids* are defended against the Tears and their mutual Collision, by the *sebaceous* Matter separated in their Glands; the Nipples, Arm-pits, *Glans*, *Urethra*, *Perineum*, &c. are all protected in the same Way. When their Defence is wanting, we see the troublesome Consequences, Excoriation, Pain, Inflammation, &c. The *internal Membrane* of the Guts being more exposed to the Action of watery Liquors, has a much more plentiful Supply of the protecting Liquors, and is always, in a sound State, lined over with Mucus. Whenever therefore this Mucus is carried off too quickly, as in *Diarrhoeæ* and *Dysenteries*, or is not seerned in sufficient Quantity, as in Inflammations, or other Obstructions of the intestinal Vessels, we may easily judge what the Consequences must be, and are led to supply by Art what Nature then is deprived of.

A certain moderate Degree of Friction makes little or no Change upon the *Cuticula*, Nature easily supplying what is carried off. When it is greater, but gradual, and not so violent, as to destroy its Texture, or to separate it from the Parts it is connected to, the Effect is not a little surprising; the *Cuticula* becomes thicker, stronger and firmer, as we see every Day in the Soles of the Feet, and in the Hands of labouring People. When sudden violent Friction is applied to the *Cuticula*, either it is rubbed imperceptibly off, or it is separated from the Skin; this daily Experience also shews every one. The *villous Coat* of the Intestines is not exposed to such Accidents as the external

nal Surface of the Body, and is better defended by the Slime from the bad Effects of rubbing Forces, while the Abrasion or Separation of this *villous Coat* may well pass so unobserved, that one cannot give Examples to prove Circumstances in it analogous to those mentioned in the *Cuticula*; the most surprising and least to be accounted for Phænomenon, to wit, the thickning and hardning of the *Cuticula* by Friction, may however be also seen in the Intestines, when any hard concreted Substance is lodged a considerable Time in any particular Part of the Guts; for then the internal Surface of the Intestines becomes there thick and hard.

The *Epidermis* seems to serve for contracting the Extremities of the cutaneous Vessels, probably by forming their Extremities; for whenever it is separated, these Vessels throw out their Liquors in much larger Quantities than ordinary. I know the Writers on this Subject generally express themselves in such Words, as would perswade their Readers they thought the cutaneous Liquors were all thrown out of their Vessels between the *Skin* and *Cuticula*, and thence gradually escaped through the Interstices of the cuticular Scales. But if this was the Case, there would perpetual Blisters be raised in the depending Parts of the Body, if not all over the Surface of it; and the Liquor in Blisters would escape through these Interstices; which it does not. The same Effusion of Liquors is made into the Intestines, upon the Separation of the *villous Coat*, in the End of Consumptions, and in other Diseases, where the

the Tongue and Throat shew the excoriated State of the alimentary Canal.

When any Part of the *Cuticula* is separated from the Skin, but still is continued with the adherent *Scarf-skin*, it becomes thicker, especially if soaked with Liquors: Thus the *Cuticle* of Blisters, and what separates from the Edges of Wounds and Ulcers, is frequently very thick. The same thing happens in the alimentary Tube, as is evident in *Aphthæ*: And this Observation only can account for the tubular thick Substances frequently voided at the *Anus*; which have been taken for Pieces of the Guts, because of their Shape and Firmness.

The *Epidermis* is the most incorruptible and least subject to Erosion of any Part of the Body. In Abscesses the *Pus* has little other Effect upon it, than to separate it from the Skin, and to tear it by its Weight, but not to dissolve it. In *Gangrenes* and *Sphaceli*, it remains uncorrupted, after all that it covers is converted into a putrid Mash; nay, it can allow the common *Lapis Septicus* to penetrate through it, and destroy the Parts below, without suffering a Solution of Union in its own Substance. Possibly this may be owing to its having no proper Vessels or Liquors. Whatever the Reason of it is, it is certain the *tunica villosa* of the Intestines enjoys the same Properties, which are of the utmost Advantage in both, considering how many Substances of different Natures are applied to them; some of which would certainly dissolve them, if they were capable of Dissolution, and would expose us to the Inconveniences

encies of Pain, Inflammation, Effusion of Liquors, &c.

Because these Membranes of which I have treated, though indissolvable, are however separable from the Parts they cover, the Consequences of which Separation are so bad, therefore they are the most easily and quickly regenerated of any Organs in the Body that are not of the same Structure.

Whoever calls to Remembrance the analogous Structure and Uses of the most internal Coat of all the hollow *Viscera*, of the Arteries, Veins, &c. will see that I point at concluding all of them of the same Nature with those I have now insisted on.

I never saw the *Appendix Vermiformis* of any of the human Fœtuses which I have dissected, distended with *Meconium*; and therefore cannot allow it to serve as a *Reservoir* of the *Fæces* during Gestation, which several Authors have imagined; but must join with those who assign it the Use of furnishing *Mucus* to lubricate the internal Surface of the *Great Sac* of the *Colon*, and to moisten the *Fæces* in it, that they may more easily be pushed forward out of this part of the Gut where there is the greatest Difficulty in their Progress, and where, by stagnating too long, they may bring on troublesome Symptoms; witness the Disease called *Placenta intestinalis* in Women with Child, which I have seen more than once in Hazard of being mistaken for some other Disease, that required a very opposite Method of Cure to what ought to have been used. The numerous *mucous La-*

cunæ observable in the human *Appendix*, and the like Structure in the *Cœca* of Brutes, are Proof enough of the *Appendix* serving the Use mentioned, both in the human Fœtus and Adults.

It will be said, that the *Appendix* being so much proportionally larger in the Fœtus than the Adult, seems to indicate some other Use it is also of to the Fœtus. But this proportional lesser Size of this little Gut in an Adult will appear to depend upon the Pressure it suffers, and being emptied so frequently of its Contents; whereas in a Fœtus there is no Respiration to squeeze it, and the *Meconium* in the *Sac* of the *Colon* prevents its being emptied; so that the Liquor separated by its Glands being collected there, softens and relaxes its Fibres, and distends it.

The Neglect of considering what the different Forces are, which act upon the several Organs of the Body, while in a Fœtus-state, and after Birth, has, in my Opinion, contributed to many Disputes, which might easily have been put an end to, by accounting for the Phænomena, which were the Subject of them, in this Way of Reasoning. I shall mention one remarkable Difference in the Circulation of the Blood, and some few Consequences from it.

Though the Heart and Arteries of Animals are able, by their Action, to keep up a Circulation in the larger Vessels, yet, without Assistance from some other Powers, they cannot propel the Liquors with Velocity enough, and in

in sufficient Quantity, through the small Vessels. These assisting Powers, after Birth, are the alternate Pressure of Respiration, and the Actions of the Muscles. We can observe at any Time how much the Circulation is quickned, by encreasing these; and on the contrary, how much all the secerning Organs are infarcted and stretched by their almost stagnating Fluids, whenever one of them, muscular Motion, to wit, is little exercised. Thus Creatures turn fat, when they have not Exercise. Hence a Recruit of all the necessary Liquors in Time of Sleep. Hence the strong slow Pulse of sleeping People. Hence the Desire of continuing Sleep, after a Person has slept beyond his ordinary Time. Hence the small Waste of such Creatures that continue long in a dormant Condition, without any Supply of Food. Hence a dry parched Mouth in the Morning, which is soon relieved by chewing. Hence a Stiffness and Laziness after abstaining from Exercise too long. And a great many other Phænomena, which will occur to any upon the least Reflexion.

Since then the Heart and Arteries of Fœtuses have little or no Assistance from any alternate Pressure, in propelling their Liquors, their secerning Organs, (where, of all the Parts of the Body, there is the greatest Complication of Vessels, divided into the smallest Ramifications, with the least Firmness, and consequently Resistance, in their Solids) must all be infarcted and distended, and therefore of a larger proportional Size than in the Adult, as we see their Brains, Liver, Pancreas, Kidneys, Breasts,

&c. are. So that the *Thymus* and *Glandulæ Renales*, about which so much Enquiry has been made, have so far nothing but what is common to other glandular Parts.

It probably will be alledged that the *Thymus* and *Glandulæ Renales* lose more of their proportional Size in the Adult than the other Organs named : Admitting this generally-received Fact, though upon comparing them with the Brain, and some others, I doubt it ought not to be admitted as commonly stated. Admitting, I say, this Fact, it will not bring us under any Necessity of being obliged to search out some particular Use they serve in the Fœtus : For a View of their Circumstances, as to Situation and Pressure, will account for all the Differences observable in them. To understand this aright, it may not be amiss previously to consider one or two Causes that may influence the Growth of animal Organs.

1. then, It will not, I believe, be denied, that the Growth of the Parts of the Body will be greatest where they are least confined, and least exposed to pressing Forces. The *Brain* is at first inclosed in Membranes, and is prodigiously large, in proportion to the other Members ; as the Bones of the Skull become firm, its proportional Size diminishes ; and after they are fully joined, its proportional Increase is very little. The *Testicles*, on the contrary, are at first confined within the Abdomen, and very small ; afterwards, when they fall down into the loose Bag, the *Scrotum*, they increase much faster.

2. The greater the Force is with which our Fluids

Fluids are thrown into Parts, or the greater the Resistance is, to the secernd, or to the returning Liquors, whether that Resistance is owing to external Pressure, Smallness, or unfavourable Situation of the Vessels, or to the Viscidity of the Fluid, *cæteris paribus*, the Bulk of a Part will be increased. A Hand swells, upon pressing the Veins of the Arm. A Tumor in the *Urethra*, near the *Caput Gallinaginis*, occasions a Swelling of the *Testicles*.

To apply these Principles to the *Thymus* and *Glandulæ Renales*, we need only call to our Remembrance the Situation of the one, in the double *Mediastinum*, between the Heart with its large Vessels, and the *Sternum*, with the Lungs on each Side. The other lies on the muscular Appendix of the Diaphragm, covered before by the chylopoietic Organs. Neither of them have any excretory Canal, except the lymphatic Vessels are esteemed such. The Veins of both have a short Course, and that of the *Glandulæ Renales* is remarkably large.

The greater Pressure which the *Thymus* suffers after Birth, from the increased Action of the Heart and of the Lungs, is altogether evident. The immediate Play of the *Diaphragm* upon the other, shews as evidently that there are scarce any glandular Parts in the Body, the Change upon which, as to Pressure, is greater after Birth, to what it was before, than in these two; and therefore, by our first *Proposition*, they should suffer in their Growth upon this Account. But to this is to be added the Thinness of the Fluids sent from them, and their short Course in large Vessels, which are

almost peculiar to them; by which their Vessels must be less distended, and consequently their Increase less, by *Proposition 2.*

Having endeavoured thus to account for the lesser proportional Size of these Organs in the Adult, I would join in Opinion with those Gentlemen, who assign them the Office of lymphatic Glands, both before and after Birth, serving to dilute the Chyle and thick Blood that is soon after to be returned to the Heart.

Having thus exercised the common Privilege Miscellany Writers assume to themselves, of digressing at Pleasure, I chuse to conclude with a Subject something nearer to what I began with.

At the Part of the *Mesocolon*, which connects the sigmoid Flexure of the Colon near the left Cavity of the Ilia, where in most adult Bodies there is an *Infundibuliform Cul de Sac.* or *Thimble-like Cavity*, I could never observe in Children more than one Part of the *Mesocolon* laid over the other, because of the great Flexure of the Gut at this Place; and therefore conclude the Cavity to be accidentally formed, by the growing together of the contiguous Parts of the *Mesocolon*: And that it is as needless to assign Uses to it, as it would be to shew how useful the Concretion of the Lungs and *Pleura* is, which seldom misses to be observed greater or less in adult Bodies.

XIII. *Observations concerning the Placenta, the two Cavities of the Uterus and Ruysch's Muscle in fundo uteri;* by Dr. THOMAS SIMSON, Chandos Professor of Medicine at St. Andrews: In a Letter to Dr. John Pringle, Physician, and Professor of Ethicks in the University of Edinburgh.

S I R,

YOU know I had come to such a Resolution in publishing a new Edition of my Treatise of the *Uterus*, as to make publick Advertisement of it: But upon a fuller Consideration of that Part which related to the *Practice*, finding it deficient in several material Points, which I have some Hopes of making more compleat from further *Observations*; I perswaded my self to delay the Publication for some Time. But that I might make some Atonement for my Delay, resolved to lay before the *Society* with you for collecting *Medical Essays*, some of the *Improvements* I had made in the Theoretical or Anatomical Part, reckoning that such Things cannot be too soon published, to give Opportunity to such as have a Variety of Subjects, to examine into what is alledged; which is the more necessary as to my Doctrine, because the Subjects that can be serviceable for this End are the worst of all to be had, and in a small Proportion to those that in general are subservient to Anatomy: I was obliged in what I have advanced, to have Recourse to the standing Observations of Anatomists, many of which had

had hitherto never been employed to solve any Questions relating to the animal Oeconomy ; and I hope the Way that I have collated them, and the Conclusions I have drawn from them, when considered conjunctly, shall shew the Usefulness of insisting upon particular Observations, in order to the making out of Systems. Except we take this Way, all our Theories shall be mere Hypotheses : But by full Collections of Observations, we may come to solve the most intricate Problems.

The Example I am to give you, is in finding out the true Rise of the *Placenta*, and the Design of dividing the *Uterus* into two Cavities, which we find the Antients did not so much as attend to ; at least *Fallopious* seems to have been the first who designed them by different Names ; and, by so doing, has given Occasion to the later Anatomists to make a great many particular Observations as to their Structure, and to me, if I mistake it not, of their Use. It was the Variation that is observable in the Position of the umbilical Cord that gave the first Rise to my Scheme, upon which I built the most of my Theory upon this Head in my System : But since, a great many other Arguments have arisen to me from different Topicks, especially from comparative Anatomy, as you will find in the Sequel.

It has been hitherto generally received, that the *Placenta* is an original Part among the Secondines. But to me, from collating Observations, it seems to have no Place in the *Ovarium*, nor in the *Uterus*, till once the *Ovum* becomes contiguous to the *Fundus* ; at which Timee

Time every Part contiguous becomes really *Placenta*, which is the whole of the *Chorion*, except that small Portion that lies contiguous to the *Cervix*: So that, according to my Doctrine, at first the *Placenta* involves the whole *Embryo*, except so much as is contiguous to the Passage from the *Fundus* to the *Cervix*, where sometimes one Part and sometimes another of the *Ovum* happens to fix; and consequently sometimes one Part and sometimes another is *Placenta*, which is vastly larger than the membranous Part at its first Appearance. Such a Phænomenon as this could not have escaped the Attention of the anatomical *Investigator*, if he had not been prejudiced with the Notion, that the *Placenta*, at its first Appearance, should have somewhat of that Proportion to the other Parts of the Secundines which it has at the Birth. The celebrated *Ruy sch* seems so prejudiced with this Notion, that he could not believe his own Eyes, that the *Placenta* was so large at its first Appearance, as he found in every Case, except one; and therefore forced himself into the Conceit, that what then appeared as *Placenta* round the whole *Embryo*, was nothing but a Coat of Blood coagulated round it; though he is so just as to own, that this Blood was so involved with the *Placenta* that he could not separate them without Violence to the *Placenta* (a). Dr. *Harvey's* Account of the Envelopments of the *Embryo* was less disguised, who tells us, That their external Surface was all over wrungled, and daubed

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(a) *Observ. Decas 2. Observ. 10. Thes. 6. num. 40.*

ed over with a Kind of Gelly or glutinous Substance, without any Appearance of the *After-Burden* (b); that is, of an After-Burden distinguished from the other Integuments, as in the last Months. And indeed amongst most of our more curious Observators, we find a like Indistinctness in their Account of the Invelopments at that Time. I shall in *Zanottus*'s Words give an Instance in a History from *Galeatus*, as *Zanottus* has given it, where he treats *de instituto & Academia Bononiensi*. *Dissectâ muliere, quam secundo circiter gravidatis mense febris oppresserat, uterum cum ovariis & tubis continuò Galeatus extraxit, scire cupiens, quemadmodum hæc haberent. Uterus sic erat. Placenta ejus fundo satis firmiter adnætebatur, quamquam adhuc erat informis; nihil, quod fœtum profiteretur, apparuit; tantum sacculus se prodiit carneæ cuidam massæ, quam vix à Placenta distinguisses, adhærens, apertumne dicam per longum an laceratum? Id Galeatio aliisque cum eo idem contuentibus suspicionem injectit, vel mulierem nihil perfectum concepisse, vel fœtum; si quem conceperat, ante ejus obitum ex illo clauistro excessisse.* The best Commentary to this History is a Case I had occasion to examine, when occasionally at *Coventry*, where a Lady of my Acquaintance miscarried about the third Month, with a great Effusion of the *Lochia*; which gave me Reason to suspect, that the After-Burden was some Time loose in the *Uterus* before it was discharged: The whole Conception was about the Bigness

(b) *De generat. Dissert. 69.*

ness of a Goose-Egg, and uniform through its external Surface, which had somewhat the Appearance of a gelatinous Substance, as *Harvey* observes : But scraping upon this, I found it much of the same fibrous thick Texture as the After-Burden in the last Months, till I came as far as the *Chorion*, from whence I scraped the fibrous Part all round, so as to leave it a pure clean Membrane, such as what *Ruyisch* mentions as the only Instance where he did not find the *Placenta* involved with Blood ; which, I think, gives just Ground to suspect, that the fibrous Part had been some how or other torn off, which is not difficult to do in that tender State. When I came to the membranous Part, I saw distinctly the fibrous Part every where inserted into it ; nor did I, through the whole Circumference, find the least Difference as to the Manner the fibrous Part was attached to the *membranous*, so as to suspect one Part for *Placenta* more than another : Only at one Part I found a small Slit that led into the membranous Bag into which the Shoulders of an aposteme Lancet would have had Difficulty to have entred. When I opened the Bag fully, there was nothing in it of *Fœtus* or Humour ; only to one Part I found hanging about an Inch of the umbilical Cord ; But though I shewed this to the Midwife and other By-standers, and argued from it, that there had certainly been a *Fœtus* there, but that it had been squeezed in the Time of Labour through the observable Slit, I could not prevent its passing abroad that the Lady had been with a false Conception ; the whole Appearance and the Want of an Embryo satisfying

fying them upon that Head : But to me it gave a very distinct Notion of *Galeatius's Case*; of his *Sacculus*, and adhering fleshy Substance, which he could not distinguish from the *Placenta*, and that the Embryo had certainly been squeezed, as in my Case, through the Aperture found in the Conception. How these Apertures happen, so as to allow the small Embryo to pass them (which we may suppose to take place frequently, since *Ruy sch* tells us the Embryo is frequently amissing, *Thes. vi. num. 81.*) may easily be understood upon my Hypothesis, that the Part of the Secundines next to the *Cervix*, where they are not contiguous to the *Fundus*, keepps always membranous, and has nothing to support it ; so that it must easily yield, and being destroyed, the Part that it covered must appear only as a Slit : But this will be more manifest in the Sequel of our Treatise. *Heister*, in the fourth Edition of his Anatomy, has given us the most distinct Account of this Affair, as you will find in the 27th *Figure*, where he has elegantly represented a *Fœtus* about three Months, included in its Integuments : In his Explanation of this Figure he tells us, that the Conception was almost quite surrounded with such a Set of vascular Fibres, as he has represented in the lateral and under Margin of his Figure ; but that he had scraped so much of them off, as to let us have a View of a *Fœtus* through the membranous Part. This Conception of *Heister's* seems to have every Thing in its natural State ; whereas, for most part, these early Conceptionss are more disguised, by lying longer in the *Uterus*, or being more squeezed when discharged ;

ged; and thus they are found frequently without the Embryo, and having the fibrous Excrencies obliterated: So that *Ruysch* could take them for clotted Blood; and to *Harvey* they appeared like so much Gelley: Which was the external Appearance of the Instance I mentioned; though, as I said, in scraping into it, the fibrous or vascular Part was most distinct. *De Graaf*, towards the End of his 15th Chapter, speaks of the same massy Appearance of the external Integuments of the more early Embryo's, as what is ordinarily to be observed, and look'd upon it as preternatural; while he tells us, that others reckoned them to be *Mola's*: Which, according to *la Motte's* Opinion, has no membranous Cover, has no Embryo, nor any Thing like an After-Burden (a). I suppose, from the Histories I have given, and the Light I have set them in, the Ground of their Mistakes, and this Definition of *la Motte's* may be easily seen into. All these Cases are *Mola's* with *la Motte*, where the small membranous Part is torn, and the Water and Embryo discharged; which happens most frequently: And I mistake it, if this has not given Ground to the Numbers of *Mola's* we have recorded amongst Observators, who are very copious upon this Subject, and has given occasion of their being distinctly treated of by every Writer almost in Midwifery, who have given us very strange Accounts of them; such as have frequently distracted the poor Woman, and put her to much Trouble and Expence: While

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(a) Des'accouchemens, liv. i. obs. 3.

the Practitioner took his Indication from such an Appearance, to put her under a severe *Regimen* and Course of Drugs, to purge the *Uterus*, from whose bad State they deduce the Rise of the *Mola*.

As we have the concurring Testimony of almost all Observators as to the surrounding of the Embryo in the two or three first Months with the *Placenta*, though somewhat disguised : So after this it is agreed upon, that the *Placenta* has still a lesser Proportion to the membranous Part of the Integuments, the nearer they come to the ninth Month. Thus *Blasius*, in the first of his *Anatomical Observations*, takes notice, That the *Placenta* covered the whole of the Embryo in the fourth Month, excepting a Space that could be covered with a Crown. In this the *Placenta* had much the Appearance as in *Heister's* Figure, according as *Blasius* describes it ; and the Extent of the *Placenta*, and its Proportion to the membranous Part is agreeable to *Ruyssch's* Representations. I had Occasion lately to see a Miscarriage of Twins, the first of which came away without its Integuments, and the other with them, all intire, in the midst of the Waters, alive, tho' but of five Months, as I guess'd from their Bigness, and as the Mother reckoned in her usual way of Computation. In both, the *Placenta* was much of the same Extent with the membranous Part, and not much inferior to what I usually find it at full Growth in the ninth Month : So that for the four last Months the Growth of the *Placenta* is very obscure, but that of the membranous Part very considerable, being at least

least five Times larger than the *Placenta* at that Time, as may be reckoned from the Bulk of the Infant, and Waters it surrounds; which is the only way we have to judge of them in the last Months, when the Integuments seldom come away entire.

When we look into these Histories then, every where to be met with, which shew us that the Embryo is wholly surrounded with the *Placenta* in the first Months, we cannot doubt of what I asserted at the Beginning of this Chapter, that the whole exterior Surface of the *Ovum* that at first is contiguous to the Cavity of the *Fundus*, is in Fact *Placenta*: But this being a new Doctrine that will require to have our Arguments set in different Lights, to convince the prejudiced Mind, I shall consider the Rise of the *Placenta* in other Animals; for I find in this Case, as in a great many other Instances, comparative Anatomy contributes a great deal to form our Judgment.

In Animals where the *Ovum* has its Supplies by Mediation of *Cotyledons*, which are original Parts in the *Uterus* or its Horns (b), nothing can be more evident than that such Parts of the *Chorion*, or exterior Surface of the *Ovum*, becomes *Caruncle* or *Placenta*, as comes in Contact with the *Cotyledons*, and these only: For Example, in the Hind, in whose *Uterus Harvey* takes notice of 10 *Cotyledons*, 5 on each Side, there are exactly so many *Caruncles* upon the *Chorion*, and of the same Extent and Figure; and in Sheep and Cows, which we have

(b) Ad finem Thes. 5. Articul. 5. Ruyfch.

Occasion to see every Day, and round whose *Chorion* Needham has sometimes found 60, 70, 80 *Cotyledons*, the *Caruncles* always correspond in Number and Shape; and that even in Cows, who at former Calvings had lost many of their original *Cotyledons*, which they frequently do: Than which nothing can give us greater Evidence that the *Caruncle* is produced upon the *Chorion* by the Influence of the *Cotyledon*. But further, in Mares and Swine all the Time the *Ovum* keeps disengaged from the *Uterus*, which it does for more than half the Time it is there, nothing fibrous or like a *Caruncle* appears upon the *Chorion*; nor do the *Cotyledons* appear, but upon the Conception coming in Contact with the *Uterus*, the *Cotyledons* appear, though but small, and *Caruncles* answering to them (c). The same Thing holds in those Animals, who have particular Cells amongst the Horns for receiving and nourishing the *Ovum*; such as Rats and Mice, in which the *Ovum* is joined to the Cell by Mediation of one *Cotyledon*; upon their Invelopments there is but one *Caruncle* exactly shaped like the *Cotyledon*: But in Dogs and Cats, and such like, where there is a particular Cell fitted for the *Ovum*, without the Mediation of a *Cotyledon*, the *Placenta* is exactly of the Shape of the Cell, which is a cylindrical Portion of a cylindrical Tube; and the Cell being open at both Ends, the membranous Part extends itself to them: So that in these Creatures the *Placenta* appears as a Belt round the *Chorion*. (And as in the Separation of the humani

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(c) Needham embriotomia.

Placenta, Blood always appears; so it does in them upon that Occasion, but not in Animals with *Cotyledons*, except the *Cotyledons* be brought away with the *Caruncles*, as I have seen frequently in Cows: So that there is no Doubt but the Cells, in which the *Ovum* fixes without *Cotyledons*, are prepared for the Engraftment of the *Ovum*, in the same Manner as is the *Fundus* of the human *Uterus*; since, as in them, all becomes *Placenta*, contiguous to the Cells, and that Part membranous which extends beyond them. And thus we find in all Animals who as yet have come under our Consideration, that it is manifest that the fibrous Part of the *Secundines* or *Placenta* is owing to the Soil; and that Nature has been solicitous to have a proper Soil for such a Production in every Animal, though she has taken a different Way to prepare it..

But though what I have now advanced gives the strongest Evidence for this Doctrine, yet there are other material Considerations which add to the Beauty and Force of our Arguments: For this is the peculiar Excellency of Truth, that upon whatever Side you view it, it appears uniform and of a Piece; and the more it is examined, it appears with the greater Simplicity and Symmetry. By this Doctrine of ours, by which we determine the whole of the *Ovum* to become *Placenta*; which is contiguous at first to the Cavity we call the *Fundus Uteri*; it of Necessity follows, that when two or more *Ova* arrive at once at that Cavity, that all their *Placenta's* will be confined to it, and consequently amongst them will only take up the Space

ordinarily possessed by one; and all of them being contiguous and taken together, will be of the Shape that the single *Placenta* has. This is a necessary Consequence of what we have formerly advanced, and I refer to all Practitioners in Midwifery, if in Births where there are more than one at a Time, they do not find either all the *Placenta's* together, or certain Marks of their having been contiguous in the Form I asserted; only that between them they make a larger *Placenta* than what we find in case of a single Birth: For every Part concerned, when Twins are produced, being extended more than in single Births, it is but just to allow that the *Fundus*, with the *Placenta* or *Placenta's*, is so likewise. In the Case of Twins I mentioned before, where I was present after the Miscarriage, I observed the Place where the Two had been contiguous, as evidently as we see the corresponding Sides of two Kernels that are contiguous in one Shell: Nay further, I evidently saw Marks of their being torn away from one another by Violence, the mutual Parts of Contact in both being evidently torn. In others I considered this in, when the Infants had come to their full Time, though I saw not so much the Marks of Violence, yet I easily discerned the Sides of the *Placenta's* that had been contiguous: But Instances, where they come away separate, are not so frequent as those where they come away still united, as *Devenier* has observed in his Chapter *de geminis præverbis*, and every one may observe. But it is still more curious to observe how this holds where there are three or four Children at a Birth,

Birth, of which we want not Examples. Thus *la Motte*, in the 42d Chapter of his Book we formerly cited, has two Instances of three at a Birth; in one of which the *Placenta's* were all joined together as one; and in the second, two were joined; and the third came away by itself. Mr. *Saviard*, in his *Nouveau recueil d'observations*, num. 82. gives us two Examples exactly parallel. *Vieussens*, in his Treatise upon the *Uterus*, tells us, That Messrs. *Codonian* and *Olavier* shewed him an Instance where the three were in one, though their Boundaries were most distinct. But what is still more observable, *Luca Shræckius* gives us a distinct Account in the *Miscell. n. curios. dec. 11. ann. 2. observ. 9. p. 26.* of four produced at a Birth by the Wife of one *James Thomas*, all of whose *Placenta's* were combined as one; though he takes notice that they were separate by certain Furrows into four Parts, each of which had an umbilical Cord insert into it, which is always the Case when different *Placenta's* are thus combined. Now what Account can be given of such a Phænomenon as this, from the common Hypothesis, that the *Placenta* is an original Part in the Secundines, and is fixed only to a certain Place of the *Fundus*? What strange Chance is it, that the four *Placenta's* should meet so neatly, as to have the Appearance of one single *Placenta*? If we should suppose but two, it would even in that Case be a great Chance if they should meet, because the membranous Part is supposed greater than the fibrous; and then, if they did meet, it should only be as two Circles in a Point; whereas in Fact they are joined the whole

whole Length of one of their Diameters. So that the whole Circumstances argue for what I advance, that the *Fundus Uteri* is of such a Virtue, that every Part of the *Ovum* that lies next it becomes *Placenta*; and if at once there are received two, three or four *Ova*, then so much of every one as touches the *Fundus* becomes *Placenta*; and of Necessity all the *Placenta's* must be contiguous, they filling up the Cavity of the *Fundus* exactly amongst them: For whether there are more or fewer, they are confined here, having their Existence from it. And as by the Light I have set the *Placenta* in, we see how the *Placenta's* are always so crowded together, when there are more than one at a Birth, so from it we come to understand how, in Cases where there are but one, as well as where there are more, the Place of the *Placenta* into which the umbilical Cord is insert, should be altogether uncertain; that is, that the Cord should be found sometimes near the Circumference, sometimes at the Center, and again, at very different Parts of the *Area*; as I every Day observe, and as *Ruyfch* has given us to know, in a Variety of Examples. By our Doctrine, the Phænomenon is inevitable; for the *Ovum*, with the Embryo attached to it, landing at the *Fundus*, that Part of it into which the umbilical Cord is insert, will answer sometimes to one Part of the *Fundus*, and sometimes to another, there being nothing to determine the loose Egg into one Posture more than another. If we suppose then that the Part of the *Ovum* into which the Cord is insert, fixed at the most vertical Part of the *Fundus*, and that

all.

all of it becomes *Placenta* contiguous to the *Fundus*, then it is plain, in that Case, that the Cord will be found at the Center of the *Placenta*. But if we shall suppose, that the Part of the *Ovum* with the Cord fixes near to the Boundary of the *Fundus* and *Cervix*, then of Necessity the Cord is at the Circumference; as I have seen it several Times, and in one Case of Twins, where the *Placenta's* were unite, both Cords were insert within half an Inch of the Circumference of their *Placenta's*. I have seen it in a Variety of Places of the *Area* different from the Center: in which Cases, the Insertion of the Cord had got a different Place of the *Fundus* to settle in from the other two. So that all these Phænomena become most plain and intelligible, upon admitting our Hypothesis, and are most certain Proofs of its Authentickness.

There is one Thing follows upon this Doctrine, which perhaps will be somewhat debated, and that is, that *extra-uterine* Conceptions can have no *Placenta*. I have consulted Authors upon this; nor can I get any Instances to the contrary: They indeed speak, as if they had no Doubt but they should have had them. But this seems to have arisen wholly from Prejudice; for upon examining into the distinctest Cases, we have no Ground to reckon that they had. Thus *Cyprianus* tells us, in the famous History he gives us, where he saved a Woman with an *extra-uterine Fœtus*, that the *Placenta* was dried up, and become membranous; so that in Fact there was no *Placenta* found at all, that Hypothesis of the Author's, of its drying up,

up, being gone into, only to account for the want of a Part which he reckoned essential amongst the Secundines, wherever found. *Sanctorinus* seemed likewise at a loss about the *Placenta* of the *Tubarian Fœtus*, which he gives the History of amongst his Observations ; in surveying which, he tells us, that he met with something *Placentæ simile* ; and in his Description of his Figure, he says, *effusa membranis adhærebat.* So that nothing can be concluded of a true *Placenta*'s being there, though he reckons the *Embryo* to have been near the fifth Month. Nor could I get any greater Satisfaction in any Case I examined : So that what I have yet met with upon this Head, rather confirms my Doctrine than opposes it, that the *Fundus Uteri* is a Place peculiarly fitted for the Growth of the *Placenta*, as well fitted Soils encourage the Growth of the Roots of Trees and Shrubs, many of which are propagated by the Branches, however placed ; so that every Part of them seems equally fitted to be Root or Branch.

Against this Doctrine, of every Part of the *Chorion* becoming *Placenta* that is contiguous to the *Fundus*, it may be urged, that sometimes in the Middle of the *Placenta* there have been found membranous Portions, such as in that Instance *Rohault* mentions in the Memoirs of the French Academy *Anno 1715* ; like to which I saw another in the Custody of the ingenious Dr. *James Douglas*, who has not a little supported the Credit of his Country, by his anatomical Discoveries. But such Examples as these, in my Opinion, rather add than detract from the

the Force of my Arguments ; since by them it would appear, that what is *Placenta* was originally membranous, which in these Cases was not changed from some bad Disposition of the Chorion or *Uterus*.

I must next consider whence the Cavity is formed, which in the last Months contains the Infant, the greatest Share of the Waters, and all the Secundines, except the *Placenta*: For since, by our Doctrine, the *Placenta* possesses all the *Fundus*, the rest of the Cavity, which contains the other Parts, must arise and have its Formation from some other Part; concerning which, we need not be at any great Loss, since the *Uterus* has, contiguous to the *Fundus*, another Cavity, which, agreeable to the Name now received, we call the *Cervix*; contiguous to which we observed the *Ovum* membranous. So that, since the *Fundus* does not distend beyond what we find the Extent of the *Placenta*, the rest of the Cavity at the last Months must arise from the *Cervix*: And agreeable to this, we find, that then the *Os Tincæ* opens immediately into one uniform Cavity, where *Cervix* and *Fundus* are confounded together. And thus, in *Deventer's* Figure of the *Uterus* immediately after Child-bed, the *Uterus* is drawn of a globular Shape, comprehending both *Fundus* and *Cervix*; and from what *Vesalius*, *Ruysch* and *Deventer* observe, concerning the Position of the round Ligaments and Tubes of the *Uterus* (*a*) in the first and last Months, it is

(d) *Vesal.* lib. 5. cap. 15. *Ruysch.* *Thes.* 8. n. 3. not. 2. *Deventr.* *ars obstetr.* cap. 9. fig. 4.

is manifest that the *Uterus* does not distend equally in all its Parts : For not only these Appendices of the *Uterus* keep very near to the *Os Tincæ*, so that the greatest part of the Bulk of the *Uterus* is above them towards the lastt Months, but those upon the one Side are much lower than their Neighbours upon the other Side, as we may observe in *Deventer's* Figure.. So that we must suppose the *Uterus* to extend sometimes to one Side more than to another.. And from this it must follow, that sometimes the *Placenta* will be found in one Place of the Cavity, and sometimes at another ; and nott as *Ruysch* and *Deventer* maintain, that it is always fixed at the vertical Part, reckoning that the Inclination of the *Uterus* to a Side deceived those who thought otherwise. But in an *Uterus* I saw with Dr. *Douglas* I mentioned formerly, where the Secundines were still *in situ*, the *Placenta* was wholly to a Side ; which gave me a certain Proof against their Authority I had formerly relied upon. But however inconstant the *Uterus* be, as to the Manner of its Distension, this is certain, that the *Placenta* inviolably adheres to the Cavity of the *Fundus* ; with this it is ingraft, and can never again shift its Place. And therefore, as we allow that the *Placenta* is found sometimes in the lateral Parts of the *Uterus*, so it is a Sign thatt the *Uterus* has distended much more on one Side than another : And this seems very much confirmed by the Observation of such as have been frequently pregnant ; few of which theree are, but who have been sensible that the Bulk of the *Uterus*, in one Course of Pregnancy,,

has

has had a very different Situation from what it has had at another.

That long-experienced Anatomist Mr. *Ruysch*, in examining into the Structure of the Part into which the *Placenta* was fixed, found, that there the Fibres ran in something of a circular Course, and were some-how centrical one with another ; and these he reckons were placed at the *Fundus Uteri*. But he seems to take the *Fundus* there in a different Sense from what we have done all along ; he meaning by it nothing else than the uppermost and most vertical Part of the Capacity of the *Uterus*, when in its enlarged State : Whereas we strictly understand by it, that Cavity *Morgagni* described under that Name, in his third Figure of the first of his *Adversaria*, we formerly cited. And by what we have advanced, we reckoned it demonstrated, that this *Fundus*, in its whole Extent, makes up what *Ruysch* called his *Musculus Uterinus*, this being the Part to which the *Placenta* infallibly adheres in all Cases : So that what *Ruysch* observed of the circular Course and centrical Position of these Fibres, in the enlarged State of the *Uterus*, must instruct us in the Make and Structure of that Cavity, which hitherto was not observed ; that it has its Fibres disposed in a circular Course, having the most vertical Part for their common Centre, about which they all turn at a less or greater Distance, being in Miniature, that very Course of Fibres *Ruysch* has described as one Muscle, and represented as such in his *Tractatio Anatomica de Musculo in Fundo Uteri* : Where we may observe, that though he has represented none

of the Fibres as a complete Circle, that yet they are all circular, keeping the Course we have defined. In that Tract he speaks, as if Part of the *Placenta* did not answer to the Muscle in some Cases; but he tells us no Instance where he found it so: Wherefore we must look upon this only as a Supposition, to answer for the Difficulty there is sometimes in separating the *Placenta*; and it is plain from the Author's Strain of arguing it was no more; which he would never have fallen into, if he had seen Things in the Light we have placed them, it being certain, from our Account of Things, that the *Placenta* can never be found separate from this Muscle, which, as we said, is nothing else than what originally was the whole of the Cavity of the *Fundus Uteri*, to which the *Ovum* inevitably fixes. Nor do I see that there is Occasion to change its Name, that has been given it in this enlarged State of the *Uterus*, that of *Ruyfch's Muscle*; since he was the first who observed its Boundaries and Figure in that State; and since it, as he asserted, answers well the Office of a Muscle, in separating the *Placenta*: For the *Placenta* of itself does not contract; and therefore, upon the Contents of the *Uterus* being discharged, and so the overstretched Fibres left at Liberty, these circular ones, attached to the *Placenta*, in contracting, must desert the *Placenta* and leave it loose, which is the Office *Ruyfch* allotted to it. And as he has caused this Part to be drawn in the Tract we have mentioned, he has described it as very concave and hollow; and I make no Doubt that these who have Occasion to see the *Uterus* immediately

mediately after Delivery, will see this Cavity forming by itself, as has appeared to *Ruysch*. What confirms me in this Notion is, that upon managing an adhering *Placenta*, I have found it included in a very distinct Pouch by itself; which I remember particularly to have happened to me in a Case where there were Twins, and where the second Child was so included in this distinct Cavity, that after the Delivery of the first, when I was searching for the *Placenta*, not suspecting Twins, I felt no more of the second than Part of the Head, though now I was in the Region of the Spleen; and before this Place there was a very large Vacancy between it and the *Os Tincæ*: After I made way for the Child, I had Occasion to bring both *Placenta*'s, though they were distinct, from the same Cavity, which was contracting very fast. If I had not had a particular Notion of the *Fundus* at that Time, I would have been very ready to have suspected an *Uterus* divided in two, or an *Uterus* with Horns. Since that Time I was called to a Woman, who continued in very hard Labour, tho' delivered of her Child, and whose Belly, immediately above the *Os Pubis*, was bulky and hard: I could not determine what the Case was, till examining with my Hand introduced into the *Uterus*, I felt the Womb hard and inflamed all round its Cavity, and Part of it forced down below the *Os Pubis* into the *Vagina*; which certainly was the Occasion of the Labour: But somewhat to the right Side, above the *Pubis*, I was very sensible of a distinct Cavity, where two or three Fingers had Difficulty to enter.

This I reckoned the *Fundus* taking its proper Form, by means of its circular Fibres ; which, according to what we have shewed from *Ruysch*, are to be distinguished from the other Parts of the *Uterus* in its enlarged State. From which History I would perswade myself, that the Design of parting the *Uterus* into an upper and under Cavity is manifest, the first being designed for the convenient Ingraftment of the *Placenta* into one certain Place of the *Uterus*, and the other for the receiving and giving Place to the membranous Part of the Secundines : By which Contrivance we see, that the *Musculus Ruyschii* and *Placenta* must always be together, and that the membranous Part of the Secundines must always be contiguous to the *Os Tincæ*. And since the considering the two distinct Cavities of the *Uterus* has given Occasion to these Reflexions, we see how lucky it was to have had them distinguished by different Names. It is this which has made Authors so pointedly examine into their different Structure and Use : And it is this that conducted us in our Speculations. And after I have carried them the Length I have here narrated, in which, I hope, I have adduced sufficient Authority, I would venture to make one Supposition, relating to the globular small Bodies scattered through the whole Bounds of the *Cervix*, amongst the many that have been made concerning them ; and that is, That they separate a mucous Humour, to keep separated the membranous Part of the Secundines and the contiguous *Cervix*: For, by our Doctrine, the whole membranous Part of the Secundines ly contiguous to the *Cervix*.

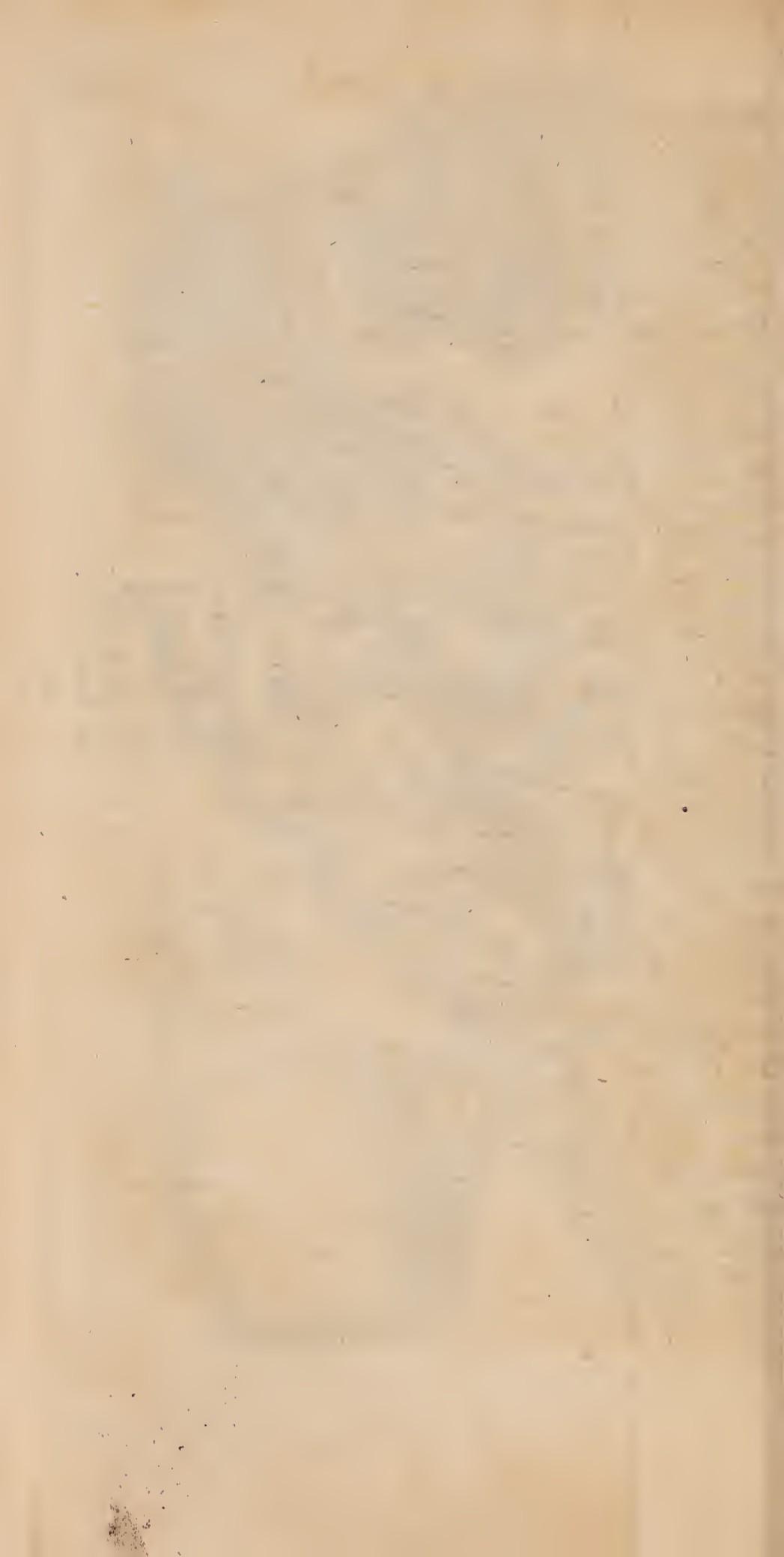
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Fig 1

Tab 1





It was most convenient then, that they should be kept from uniting ; and Nature, for this End, in other Places, has contrived such a Set of small glandular Bodies ; so that it is natural to suppose they may be employed the same Way here : For in Pregnancy, by our Supposition, the inner Surface of the *Cervix* is so dilated, as to be of equal Extent with the membranous Part of the Secundines ; and of Consequence, the glandular Bodies will be proportionally scattered through that Space ; and in their most enlarged State, come to supply that great Quantity of mucous Humours that flow from Women near the Time of the Birth : Which must certainly flow from the whole Bounds between the membranous Part of the Secundines and contiguous Part of the *Uterus*, and so lubricate much the *Os Tincæ*, as *Sanctorinus* would have them. Whose Account of this Part, both as to the Largeness of the *Cervix* towards the Birth, and the Disposal of these glandular Bodies, answering much our Hypothesis, I shall set down here, for the Satisfaction of my Readers, *Observ.*

Anat. cap. II. § 9. Ad puerparum autem repetitas dissectiones quod attinet, incredibili penè numero mucosas eas vesiculas per amplissimam tum temporis Uterinæ cervicis cavitatem disjectas comperi; ut vel harum numerum: pregnationis tempore augeri, vel quod majus consönum est, earundam vix visibilia corpuscula, usque adeo adolescere dicendum, quo extillante humore tum sensim earum membranarum relaxentur fibræ, tum præter aliud fortasse quodpiam pregnationis commodum facilius illac pertransienti fœtui via sternatur.

And thus, Sir, I have laid before you the Facts which I think conduce most for forming a right Judgment of these two Cavities, into which we find the Body of the *Uterus* naturally divided; and I am apt to persuade myself, that thereby I have somewhat contributed to the clearing the History of that obscure, tho' efficacious *Viscus*. It is but very lately since we came to have any Notion in what Manner its Appendices, the *Ovarium* and *Tubes*, were employed: But the Observations which put it out of Doubt, that the Conception is sometimes found in the *Ovarium* and *Tubes*, and the Experiments made upon Brutes, have cleared and demonstrated each of their Offices beyond Contradiction. *Morgagni* had of late given us a beautiful Scheme of the *Fundus Uteri* from the Life, whereby we could not but be satisfied with the Uniformity of that Cavity, and what immediate Access there was from it to the Mass of Blood; and demonstrated further, that the *Placenta* was certainly contiguous to the Blood in Pregnancy. *Ruysch*, about the same Time, took notice, that where the *Placenta* fixed, there was a Muscle some-how proportioned to it. What I pretend to determine is, that all this uniform Cavity has the *Placenta* attached to it; and that it was most certainly calculated for its Service: This the Figure of early *Placenta's* demonstrates; this the Combination of *Placenta's*, when there is a Plurality of Children; this the Variation of the umbilical Cord; this comparative Anatomy makes appear, with that Consistency and Simplicity wherewith Truth is always accompanied. And can we imagine,

imagine, since the *Placenta* was to have a Muscle surrounding it, that a more certain Method could have been fallen upon to adjust their relative Position? Or that a securer Method could have been contrived, for the steady Ingraftment of the *Ovum* and *Uterus*? And for determining that the membranous Part of the Secundines should always be adjacent to the *Os Tincæ*? And I hope that the whole of the History will be the more acceptable to the Anatomist, that it gives us a rational Account of *Mola's*, which hitherto had so much obscured the History of the *Uterus*.

XIV. *An Essay concerning the Motions of our Eyes; by WILLIAM PORTERFIELD, M. D. Fellow of the College of Physicians at Edinburgh.*

P A R T II.
Of their internal Motions.

HAVING, in the former Part of this Essay, treated of the *external Motions* of our Eyes, I shall now, without much Preface or Introduction, enquire into the *internal Motions* of these most beautiful and useful Organs.

This is indeed a very curious and entertaining Subject; but it is very difficult and extensive: It takes in not only those Motions, whereby our Eyes are fitted for seeing distinctly at different Distances; but it also takes in the Motions of the *Uvea*, serving to dilate and contract the Pupil: To each of which belongs a good deal

deal of subtle Anatomy, both human and comparative; and both together comprehend almost an entire System of Opticks; not a mathematical System, but, which is more, a physical one, which includes and supposes all that is mathematical in this Science.

It is not therefore to be expected that I should here attempt at exhausting this Subject. This is a Work that is not to be executed in the narrow Bounds of such a Paper as this. And to write a Volume, or even any methodical finished Treatise, is neither my present Business nor Inclination. All I propose is an Essay fit for these Collections: In which my chief Purpose shall be, to fix and establish such of the fundamental Principles appertaining to this Subject, as may be of most general Use, for explaining the Phænomena of Vision, and for tracing up morbid Symptoms to their first Causes; without which there is no Foundation on which a sure and rational Practice can be built. As for other Things of less general Use, and that have but little Influence on Practice, they are no Part of my present Design; and therefore shall not be meddled with, but by the By, and when they may serve for illustrating and confirming the Doctrine I embrace.

Now the *internal Motions* of our Eyes are either such as respect the Change of Conformation, that is necessary for seeing distinctly at different Distances, or such as only respect the Dilatation and Contraction of the *Pupil*.

That our Eyes change their Conformation, and accommodate themselves to the various Distances of Objects, will be evident to every body,

who

who but reflects on the Manner and most obvious Phænomena of Vision. It is now well known, and it has been demonstrated, beyond all Exception, that when a Man views any Object, the Light which comes from its several Points is so refracted by the transparent Skins and Humours of the Eye, as to converge and meet again, at so many Points, in the Bottom of the Eye, and there to paint the Picture of the Object upon the *Retina*, with which the Bottom of our Eye is covered; which Picture being propagated by Motion, along the Fibres of the optick Nerves, into the Brain, is the Cause of Vision; for accordingly as these Pictures are perfect or imperfect, the Object is seen perfectly or imperfectly.

Thus in general Vision is performed; and to be convinced thereof, we need only take off, from the Bottom of the Eye, a small Bit of the *Sclerotis* and *Choroides*, and having, instead of them, applied the Membrane of an Egg, or a Bit of oiled Paper, that the Humours may not escape; place this Eye at a Hole in the Window-shut of a dark Chamber, so as the Bottom of the Eye may be towards you; for you shall then see, through the Membrane or oiled Paper, the Pictures of external Objects lively painted on the *Retina*, with their proper Figures and Colours; only these Pictures will be inverted, just as it happens in the vulgar Experiment of the *Camera obscura*, where the Images of external Objects are received upon a Sheet of white Paper, placed at a due Distance behind the *Lens*. But it must still be remembred, that, according as these Pictures of external

ternal Objects formed on the *Retina* are more or less perfect and exact, the Object itself will be seen more or less perfectly and distinctly: For when the Rays that come from any Point of the Object are not exactly united upon the *Retina*, the Picture of this Point will not be a Point, but a Spot; which being confounded with the Pictures of the neighbouring Points, must render Vision very confused and imperfect. We have an Example of this in the Eyes of *old Men*, whose Humours are so much wasted and decayed, that, through a Penury thereof, the *Cornea* shrinks and becomes less convex, and the *Crystalline* grows flatter than before; by which Means the Light is not sufficiently refracted, and, for want of sufficient Refraction, does not converge to the Bottom of the Eye, but to some Place beyond it; and, by Consequence, paints in the Bottom of the Eye a confused Picture, and, according to the greater or lesser Confusion of this Picture, in the more or less flat Eyes, the Object itself appears more or less confused and indistinct. This is the Reason of the Decay of Sight in *old Men*, and shews why their Sight is mended by Spectacles; and the contrary happens in *short-sighted Men*, whose Eyes are too convex and plump: For the Refraction being now too great, the Rays which come from the several Points of the Object will be made to converge, so as to convene, in so many distinct Points, within the Eye, before they come at the *Retina*; and therefore will, after crossing one another, where they meet within the Eye, again diverge, so as the Picture made in the *Retina*, by these diverging Rays,

Rays, and the Vision caused thereby, will not be distinct, unless the Object be brought so near the Eye, as that the Place, where the converging Rays convene, may be removed to the *Retina*, or that the Plumpness of the Eye be taken off, and the Refractions diminished, by a concave Glass, of a due Degree of Concavity; or, lastly, that by Age the Eye grows flatter, till it come to a due Figure: For *short-sighted Men* see remote Objects best in old Age; and therefore they are accounted to have the most lasting Eyes.

But though it is certain that all Objects are seen perfectly or imperfectly, according as their Image on the *Retina* is perfect or imperfect; yet we are not from this to imagine, that the Eye, or rather the Mind, by Means thereof, does ever see any such Image on the *Retina*; or that it judges of the Object from what it observes in this Image. This is a vulgar Error, which, on Reflexion, every one's Experience must soon convince him of; and it cannot be denied but every body is himself best Judge of what he sees. This I have taken notice of in the former Part of this Essay; where I have also demonstrated, that all the Perceptions of the Mind are present with it, and in the *Sensorium*; and that, in seeing Objects, the Mind, by means of an *original* and *connate Law*, traces back its own Perceptions, from the *Sensorium* to the *Retina*, and, from thence, along right Lines drawn perpendicularly to the *Retina*, from that Point of it, where the Impression is made by the Image, to the Object itself; whence it is, that the Mind, or visive Faculty, does

does always see every Point of the Object without the Eye in these perpendicular Lines: From which it is easy to understand, how the Object appears perfect or imperfect, according as its Image on the *Retina* is perfect or imperfect, without having Recourse to the groundless Supposition, of the Mind's seeing a Picture in the *Retina*; for when the Rays that come from the several Points of the Object are not exactly united upon the *Retina*, the Picture of each Point being a Spot that takes up a considerable Space upon the *Retina*, and that is confounded with the Pictures of the neighbouring Points, which also are Spots, it must make these Pointss to be seen in a great many Places, and a great many Points to be seen in the same Place: From which Confusion the Appearance of the Object will be confused and indistinct. Thus: (in Tab. II. Fig. 1.) let COB be an Object, whose Points O, B and C, by emitting Rayss that are not reunited at the *Retina*, but beyond it as far as X, do upon the *Retina* form the circular Images o, b and c; and let F be the Centre of the Eye, through which every Line that is drawn perpendicular to the *Retina* must pass. From the extreme Points of these circular Images on the *Retina*, o, b and c, draw right Lines to the Point F, and continue them to the *Hropter*, as in the Figure; these Lines, by reason they pass through the Centre of the Eye F, will be perpendicular to the *Retina*: Whence it is evident, that the Points O, B and C must be seen without the Eye, in the whole of the circular Spaces OCIB, BOLH and CGKO, which are comprehended within the straight Lines

Lines drawn perpendicularly to the *Retina*, from the extreme Points of the Images of the respective Points; which Circles being confounded with one another, it follows, that the Points O, B and C must, for the Reason above observed, appear confused and indistinct, though the Eye sees not the Confusion that is in their Images at the *Retina*.

From what has been now said concerning the Manner of Vision, it follows, that, in order to see Objects at different Distances distinctly, it is necessary that there should be a Change in the Eye, lest the Place, in which the Picture of the Object is exact, should fall short of, or beyond the *Retina*, and so cause the Vision to be confused: For Instance, if just now my Eye is of such a Conformation, as that, when I look upon an Object at a Foot Distance, I see it perfectly and distinctly, by reason, that the Rays, which, in coming from the several Points of the Object, fall upon my Eye, are so refracted by the Humours thereof, as to converge and meet again in so many distinct Points at the *Retina*; if this same Object be removed to five or six Foot distance, and the Eye, at the same Time, retain unalterably its former Conformation, it must appear confused and indistinct; because the Rays, which come from the Object at this Distance, are less diverging, than when it was at a Foot distance; and consequently will, in passing the *Humours* of the Eye, be made to convene before they reach the *Retina*, and so paint thereon a confused Image of the Object: Whence it seems evident, that, in order to see Objects equally distinct, at one Foot's

Foot's distance, and six Foot distance, it is necessary that the Eye change its Conformation; either, by having its Humours made more or less flat, or, having the Distance betwixt the *Crystalline* and the *Retina* increased or diminished. And this does likewise further appear, by the Analogy of the Images painted on the *Retina*, and those painted on a Sheet of white Paper, by Means of a *Lens* placed at a Hole in the Window-shut of a dark Chamber; for if the *Lens* be of such a Convexity, as is necessary to paint the Image of a Body, at a Foot Distance from it, distinctly upon a Sheet of white Paper, five or six Inches behind the *Lens*, the same Object, removed to the Distance of six Feet from the Window, will not be painted exactly upon the Paper, unless, in place of the former *Lens*, you substitute one less convex, or diminish the Distance betwixt the *Lens* and Paper, by bringing the Paper nearer the Window.

And here it may not be improper to observe how careful Nature has been to form the Eyes of all Animals, so as, upon all Occasions, to see Objects distinctly at an ordinary Distance. Every Body knows that the *Cornea* is always protuberant, and more convex than the rest of the Globe; but in all Animals this Protuberancy is not always the same: In Man, and the greatest Part of Quadrupeds, the *Cornea* is a Part of a Sphere, whose Diameter is an eighth Part less than that of the *Sclerotica*; but Birds have their *Cornea* much more elevated and convex, being Part of a Sphere, whose Diameter is only the half of the Diameter of the *Sclerotica*.

tis. Now, the Use of the *Cornea*, with the aqueous Humor which lies behind it, being to begin the Refraction of the Rays of Light, which is afterwards perfected in the *crystalline* and *vitrous Humors*, so that all that proceed from the several Points of the Object are again united in so many corresponding Points on the *Retina*, it may be asked how it comes to pass, that this great Convexity of the *Cornea* in Birds does not render their Sight confused and indistinct, by increasing the Refraction, and making the Rays meet at some Point before the *Retina*, as always happens to *short-sighted Men*, who never see Objects distinctly at an ordinary Distance, by reason their too plump and convex *Cornea* makes the Rays convene too soon behind the *Crystalline*. To this we answer, That this great Convexity in the *Cornea* of Birds is so far from rendering their Sight confused, that it is absolutely necessary for distinct Vision; for it is to be observed, that as in Man and Quadrupeds, the Figure of their Eye is almost spherical; in *Birds*, as well as *Fishes*, it is flat and depressed, both in its fore and back Parts; by which Means the *Retina* is placed near the *crystalline Humour*: And therefore, were not the *Cornea* of a Convexness, answerable to the Flatness of their Eyes, and Distance of the *Retina*, the distinct Image of the visible Object would fall behind it, and thereby the Sight would be rendered confused and imperfect, like that of old Men, who cannot see Objects distinctly, especially at a small Distance, by reason their Eyes have become too flat, in proportion to the Distance of the *Retina*: And therefore provi-

dent Nature, who was never found to neglect any Thing for perfecting the Organs of Animals, has very wisely increased the Convexity of the *Cornea* in such Creatures as have their *Rétina* brought near to the *Crystalline*, by the Flatness of their Eyes; for being thereby enabled to see Objects distinctly at an ordinary Distance, they can, by changing the Conformation of their Eyes, adapt them to all other Distances necessary.

To the same Purpose also belongs the different Figures that have been observed in the *Crystallines* of different Animals. In Men, Quadrupeds, and the greatest Part of the Bird Kind, it is always *lenticular*; but in such as always reside in Water, as do the greatest Part of Fishes, its Figure is that of a Sphere or Globe; and in those Creatures that are sometimes upon Land, and other Times in Water, as the *Sea-Calf*, the *Crystalline* has a middle Figure betwixt that of a *Lens* and *Globe*.

These are the Differences which have been found in the Figures of the *Crystalline*, all which are the very best that could have been, for perfecting the Sight of these Animals, and are exactly fitted to their several Circumstances and Occasions: For with respect to Man and such Animals as live constantly in Air, it is not doubted that they are of such a Degree of Convexity as qualifies them for seeing distinctly at an ordinary Distance, and this is what all of us constantly experience; but then it may be enquired, how it comes to pass that since, in Land-Animals, the lenticular *Crystalline* is sufficient to refract the Light as much as is necessary

cessary for Vision; the spherical *Crystalline* of Fishes does not, by its greater refractive Power, convene the Rays, before they come at the *Retina*, and thereby render their Sight confused and indistinct, excepting only when the Object is very nigh. To this I answer, *imo*, That the Eyes of Fishes are flat, both behind and before, by which Means the *Retina* is not so far removed from the *Crystalline*, as in Man and Quadrupeds, whose Eyes are nearly a perfect Sphere; and therefore that the Rays might be made to meet at a Point on their less distant *Retina*, it was necessary the Refraction should be increased by the spherical Figure of the *Crystalline*. But this is not all; for their spherical *Crystalline* would be more than sufficient for the Distance betwixt it and the *Retina*, were it not that the Rays of Light suffer no Refraction in their *Cornea* and aqueous Humour. Every Body knows that the Light is never refracted, but when it falls obliquely on a Surface which intercedes *Mediums* of different Densities, and therefore it can suffer no Refraction in falling upon their *Cornea* and aqueous Humour, because they are of equal Density with the Water in which they swim; to compensate which, it was absolutely necessary that their *Crystalline* should have a spherical Figure for increasing its Refraction, that the Rays might be brought together to a Point in the *Retina*: But in Land-Animals, their lenticular *Crystalline* is sufficient for that End; because the Rays of Light which pass from the Object, through the rare *medium* Air, suffer a Refraction in falling upon their convex and more dense *Cornea*, and therefore need

not afterwards so much Refraction in the *Crystalline*; and this is the Reason of that Difference that is found in the Figure of the *Crystalline* in the Inhabitants of Air and Water. From which it is easy to see, why this Humour is of a middle Figure, betwixt that of a *Lens* and a *Globe*, in the *Sea-calf*, *Cormorant*, &c. For it being necessary that these and such like Animals as dive in pursuit of their Prey under Water, should see both when in Water and upon Land. This could be no better effectuated, than by giving the *Crystalline* that middle Figure, which, as is evident, must refract the Rays too much when upon Land, and too little when in Water; but by the Change that is made in the Conformation of the Eye, they are enabled to see distinctly enough in both. Hence it is that the *Cormorant*, that large voracious Bird, about the Bigness of a large Capon, does pursue its Prey under Water with such Nimbleness and Agility, and for a long Time together, till at last it catch it, which it doth with a Dexterity which is very surprising: And therefore having first put an Iron-ring at the Bottom of its Neck, to the end that the Fish being received into the *Oesophagus*, which is very large, making a kind of Craw, may not enter into the *Ventricle*, it is frequently employed for fishing, and is said to afford a very agreeable Diversion; and what adds thereto is, that after it has seized a Fish, it always throws it up into the Air, and catches it again by the Head as it falls down, that it may swallow it entire, and without Loss of Time: But because of the Ring about its Neck, the Fish gets no further than its Gullet, which being

being large and yielding, stretches into a large Pouch or Bag, in which the Fish are kept, till it be full ; when they force it to come to the Land, and throw them up entire.

From these and such like Arguments taken from the Manner of Vision, most Physicians, as well as Philosophers, have been brought to believe, that we have a Faculty of changing the Conformation of our Eyes, in order to see Objects distinctly at different Distances ; yet the famous French Academist *Mr. de la Hire* is of a contrary Opinion, and contends, that at whatever Distance Objects be placed, yet the Eyes never alter their Conformation ; and this he endeavours to demonstrate from several Reasons, and particularly from the following Experiment, which is truly very ingenious and beautiful.

Take a Card, and pierce it with a Pin in two, three or more Places, so as the most distant Holes be not further from one another than the Wideness of the *Pupil* : This done, shut one of your Eyes, and apply the Card close to the other, so as to view a small Object through its Holes ; you shall be surprised to see this Object multiplied as many Times as there are Holes in the Card, providing it be placed out of that precise Place, where it would be most distinctly seen by the naked Eye ; e. g. If I see an Object distinctly when at a Foot Distance, it will appear single at that Distance, when viewed through the perforated Card ; but if it be removed to four, five or six Feet Distance, it will always appear multiplied as often as there are Holes in the Card. In like manner,

ner, if the Conformation of the Eye be such, as it cannot see Objects distinctly but at four Feet Distance, it will at that Distance appear single through the Card, but at all lesser Distances it will be multiplied.

This Experiment I have taken notice of in the former Part of this Essay, where I have observed, that to make it with Exactness, you must for an Object look to a small luminous Point in a dark Place, such as a little Hole in a Card plac'd before a Candle, or else you must look at a small black Object placed before a white Surface.

Now it is certain, that if the Rays of Light that come from each Point of the Object are exactly united in a corresponding Point of the *Retina*, the Object will always appear single, tho' it be viewed through several small Holes, for the little luminous Cones, OHH, Ohh (Fig. 2.) which have for their Apex or Top a Point of the Object, O, and for their Basis the little Holes in the Card, HH, hh, will also have all their opposite Tops oo, in one and the same Point o, of the *Retina*, RR, which must needs make the Object appear single: But if the Eye have not that Conformation, which is necessary to reunite these Rays in a Point in the *Retina*, each of these little Cones will be cut by the *Retina*, either before or after their Reunion, and therefore each Point of the Object shall, by its Rays, touch the *Retina* in as many distinct Places as there are Holes in the Card, and consequently the Object will appear multiplied, according to the Number of Holes. Thus if the Rays convene before the *Retina*, let AB be the

Retina,

Retina, it is evident from the Figure that this must receive the luminous Pencils at two distinct Places x and x . And if the Rays convene behind the *Retina*, let CD be the *Retina*, which also must receive the luminous Cones at the distinct Places c and c . In both which Cases the Object must appear double, by reason that its Picture falls on two distinct Places of the *Retina*: Whence it is easy to see, that if the Card be pierced in three or more Holes, so as the most distant Holes may not be further from one another than the Diameter of the Pupil; the luminous Pencils, and the Places in the *Retina* where these Pencils do fall, must be multiplied according to the Number of Holes; from which Multiplication the Object itself must also be equally multiplied. From all which the above named Author concludes, that the Conformation of our Eyes is never changed, at whatever Distance Objects be placed. For suppose that I see an Object distinctly at a Foot Distance, and at the same Distance it appears single, when viewed through the perforated Card; if to see the same Object at four Feet Distance, it were requisite that the Eye changed its Conformation; then he concludes it would do so, when the Object is viewed at that Distance through the Card, which does not happen, as is evident from its being multiplied.

This is the great Argument whereby *M. de la Hire*, both in the *Journal des Scavans*, Ann. 1685, and in his Dissertation sur les differens accidens de la viue published in the Year 1693, endeavours to prove that the *Crystalline* does not change its Figure or Situation, and in general

neral that the Eye receives no new Figure or Conformation, in viewing Objects at different Distances. And to do Justice to the learned Author, it must indeed be acknowledged, that at first View the Argument seems to go a great Way towards a full Demonstration of what he alledges; nor, so far as I know, has any Thing been yet offered by any Author, whether Physician, Anatomist or Optician; that can in the least weaken or disprove it; and yet all of them, excepting *Maitre Jean* and some few others, continue to teach, that our Eyes change their Conformation according to the Distance of Objects, without so much as once taking notice of *De la Hire's* Reasoning, or attempting at an Answer; which must appear very strange to every Body that considers the Character of the Author, the Strength of his Reasoning, and how long ago it is that his Opinion has been published to the World.

In answer to this Argument of *De la Hire*, I once suspected that when an Object is viewed through a perforated Card, the Eye, by endeavouring to see the Card, adapted itself to as near a Distance as it could, and by continuing in that State, occasioned the Object to appear multiplied, when at a greater or lesser Distance than that to which the Eye is then accommodated: But by some Experiments to be mentioned below, it soon appeared that the Eye did not endeavour to see the Card, nor by any such Endeavour was it accommodated to the nearest Distance possible; and therefore something else must be sought for, in order to reconcile this Multiplication of the Object with our

our having a Power of accommodating our Eyes to its Distance.

But for the better understanding this Matter, it may be proper, before I go further, to clear up the State of the Question, by admonishing the Reader, that it is not here meant to enquire, why a small Object is thus multiplied, when plac'd without the Limits of distinct Vision: it being evident, that it ought then to appear multiplied, by reason that the Eye can never adapt itself to its Distance. Thus if I cannot see distinctly any Object that is nearer than half a Foot, it must appear multiplied at four Inches; and if I cannot see an Object distinctly that is further off than two Foot, it must appear multiplied at three Foot, and all greater Distances. But my Meaning is to account for this Multiplication, when the Object is plac'd within the Limits of *distinct Vision*, which we have here supposed to be at a Foot and a half distance from each other: And after various Conjectures on the Matter, I am now at last fully satisfied, that there are two Causes that concur in producing this Phænomenon, by hindring the Eye to accommodate it self to the Distance of Objects viewed through the perforated Card, *viz.* the distinct Appearance of the Object, and the Mistake that the Mind commits with respect to its Distance.

That the Object appears distinct, when viewed through a perforated Card, is evident from Reason as well as from Experience; for the little luminous Cones OHH Ohh, (see Fig. 2.) which have for their *Apex* or Top a Point in the Object O, and for their *Basis* the little Holes in

in the Card HH, hh, will, by reason of their Acuteness, proceeding from the Smallness of the Holes, take up but a very little Space upon the *Retina*, whence the Object must appear pretty distinct. Thus if the Object is at too great a Distance, let o be the Place where the Rays convene, and let AB be the *Retina*; it is plain that the luminous Pencils will fall on the *Retina* at x and x, where, for the Reason just now mentioned, they must take up but a very little Space, and consequently the Confusion must be very small. In like manner, if the Object is too near, let CD be the *Retina*, and o the focal Point where the Rays are united, these Pencils will, at c and c, occupy so small a Space on the *Retina*, as to occasion no sensible Confusion in the Object; whereas, in both Cases, had it not been for the Interposition of the Card, the luminous Cone mom, would, on the *Retina*, have taken up the whole Space xx or cc, which must have rendered the Appearance of the Object very confused and indistinct. To correct which Confusion, the Eye changes its Conformation, and adapts itself to the distance of Objects seen with the naked Eye. But when by means of the perforated Card this Confusion is taken off, the Mind will not then change the Conformation of our Eyes, there being nothing that should influence it to such an Action. And this is one Reason why the Object is so frequently found multiplied, according to the Number of Holes through which it is viewed, though it be placed within the Limits of *distinct Vision*, to which the Eye can perfectly accommodate it self.

But

But there is yet another Cause which must concur towards this Multiplication, and that is, the Mistake into which the Mind falls, with respect to the Distance of the Object. It is not enough that the Mind perceives no Confusion : For though this Confusion in our Sight is commonly believed to be the only thing that can influence our Mind to change the Conformation of our Eyes ; yet by reason of that necessary Connexion and Dependence, that will be hereafter shown to have been established by Habit and Custom betwixt those Motions, whereby the Conformation of our Eyes is changed, and certain corresponding Motions of the *Axes of Vision*, these Motions come at last always to accompany one another, and that so necessarily as to make it impossible for us, by any Act of Volition, to direct our Eyes to any Object within the Limits of *distinct Vision*, without, at the same time, giving them that Disposition that is necessary for seeing distinctly at that Distance ; and therefore though there should be no Confusion in the Object, when seen through the perforated Card, it would not then appear multiplied, if placed within the Limits of distinct Vision, did not the Mind mistake its Distance : For when the Mind judges rightly of the Distance of any Object, both Eyes are necessarily directed towards it, and that as well when one of them is shut, as when both are open ; from which Direction of our Eyes, they must also be accommodated to its true Distance : Whence the Object will not appear multiplied, and therefore there must be another Cause, besides the distinct Appearance of the Object, that

must concur in this Multiplication ; and that is the Mistake the Mind commits, with respect to its Distance.

I know that *M. de la Hire* affirms, that we judge rightly of the Distance of Objects view'd through a perforated Card, and indeed most People, upon Trial, will be apt to fall into the same Mistake ; but we will afterwards have Occasion to touch upon all the Means the Mind can possibly employ for judging of the Distance of Objects ; from which it will appear, that in the Case before us, we can scarce form any Judgment with respect to Distance, but what is wholly founded upon Prejudice and Anticipation, which cannot fail of betraying us into Error and Mistake. Seeing then that we are so liable to be mistaken in the Judgment we form of the Distance of Objects seen through a perforated Card, it needs be no Surprize that the Eye should not be accommodated to their true Distance ; and that for want of this Accommodation they should appear multiplied according to the Number of Holes through which they are viewed.

Thus I have fully answered the Argument wherein *de la Hire* places his main Strength, and have shown that the Eye may be possessed of a Power of changing its Conformation, and of adapting itself to the Distance of Objects, though this Power should not be exerted where the Object is viewed through a perforated Card. But then our Author alledges, that from an anatomical Examination of all the Parts belonging to our Eyes, it will be found that none of them are capable of making any of those Chani-

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ges in the Eye, that are supposed necessary for seeing distinctly at different Distances; but this we shall consider afterwards, when we come to enquire into the Causes of these inward Motions in our Eyes.

There is yet another weighty Argument brought by the learned Author against this Change in our Eyes; and that is, that there is no Need of supposing any such Change; and that the Eye can see Objects distinctly enough at different Distances, so as not to be sensible of any Defect in the Sight, without being obliged to have Recourse to any Change in its Conformation.

For understanding this, we must first observe, that if any Object appear distinct at six Foot distance, that is, if the Conformation of the Eye be such as is necessary to refract the Rays which come from a Point of the Object at that Distance, so as that, in falling upon the *Retina* after Refraction, they impress it with a distinct Image of that Point from whence they came, then at whatever greater Distance the Object be placed, it will also appear distinct: The Reason of which is, that when the Object is at six Foot distance, the Rays which, in coming from a Point thereof, fall upon the Pupil, are nearly parallel; and therefore at whatever greater Distance the Object be placed, the Rays may be conceived as parallel, and consequently the same Conformation of the Eye that is necessary to refract them, so as to make the Object appear distinct at six Foot distance, will also refract them in the same way, and thereby

make it also appear distinct at all greater Distances.

Now this being understood, let us see how *de la Hire* accounts for distinct Vision at different Distances, without changing the Conformation of the Eye.

Suppose then that a Man's Sight is good, that is, that he sees Objects distinctly enough at a Foot distance, and likewise at six Foot distance; it follows from what has been said, that to see Objects at all greater Distances than six Feet, there is no Need of any Change in the Conformation of the Eye: So that the only Question is, How the Object can appear distinct, both at the distance of six Feet, and of one Foot, without suffering any Change in its Conformation?

To this the above named Author answers, That to see Objects so distinctly, as not to be sensible of any Defect in the Sight, it is not needful that the Rays, which come from a Point in the Object, should be united accurately in a Point in the *Retina*, but that it is sufficient they should be nearly so: Whence he concludes, that if the Conformation of the Eye be such, as when an Object view'd through two Holes in a Card at two Foot distance appears single, because all the Rays that come from the several Points of the Object, are united accurately in so many Points in the *Retina*; then, at one Foot distance, the Place where the Rays meet will be a little behind the *Retina*, and at six Foot distance it will be a little before it, though not so much in either Case as to render the Object indistinct; because

cause the Rays which come from the several Points in the Object, do, in falling upon the *Retina*, meet nearly though not accurately, in so many corresponding Points: And therefore he concludes, that those who have their Eyes of a Conformation proper to see Objects most distinctly at two Foot distance, will also see them distinctly enough both at one Foot distance, and six Foot distance; and if they see distinctly at six Foot distance, then they must also see distinctly at all greater Distances: And thus he accounts for that perfect Vision which stands in the Middle betwixt short and long Sight, without any Change in the Eye.

And as for the Sight of *old Men* who cannot see distinctly at any less distance than three Feet, he supposes that their Eyes are of a proper Conformation to see Objects at four Foot distance most distinctly; from which he infers, that at three Foot and all greater Distances, the Picture of Objects upon the *Retina* will be pretty distinct, and consequently they will be seen without any sensible Confusion, though the Eye suffers no Change in its Conformation.

In like manner, in those that are *short-sighted*, and can't see Objects distinctly at a greater Distance than a Foot, he supposes the Eye to be of a Conformation proper to see most distinctly at half a Foot's distance; and thence concludes, that the Picture made on the *Retina*, when the Object is at any Distance betwixt four Inches and a Foot, will not be confused; and consequently the Object will be seen distinctly enough, without any Change in the Eye, unless its Distance be greater than a Foot.

or less than four Inches; in which Case the Image on the *Retina* will begin to be confused, and consequently the Object itself will also appear confused and indistinct.

This is in few Words the Sum of what *de la Hire* advances, concerning our seeing Objects distinctly at different Distances, without having Recourse to any Change in our Eyes. And indeed it can't be denied but the Eye has some Latitude of seeing Objects distinctly, without changing its Conformation, though they be a little further from, or nearer to the Eye, than what is necessary for collecting the Rays that come from the several Points of the Object, in so many precise Points in the *Retina*; and that because, when the Object is not far removed from that Place, at which the Rays coming from the Object meet again at the *Retina*, the Image thereof will be pretty distinct, and therefore will not occasion any sensible Confusion of Sight: But it does not from thence follow, that our Eyes do not change their Conformation, when Objects are much removed from that Place where they appear most distinctly: For besides what we have said before, in speaking of the Images of external Objects, cast upon a Sheet of white Paper, by means of a *Lens* placed at the Hole in the Window-shut of a dark Chamber, where we observed, that in order to make the Image distinct, it was necessary, according to the different Distance of the Object, either to change the *Lens*, for one more or less convex; or to change the Distance betwixt it and the Paper, by bringing the Paper nearer to, or further from the *Lens*, according

cording to the different Distances of the external Object; I say, besides this, Experience teaches us, that the Conformation of our Eyes is changed, in viewing Objects at different Distances. For every body knows, that the Eye can't see equally distinctly at the same time Objects at different Distances, *e. g.* if with one of your Eyes, the other being shut, you look attentively to a small Object, suppose a Pin, at half a Foot or a Foot from the Eye, and at the same Time place another at six Foot distance, that at six Foot will appear exceeding confused; but if you apply yourself to observe accurately that at six Foot distance, then it will be seen distinctly, but the other next the Eye will appear very confused and imperfect; which plainly shews, that when the Disposition of the Eye is such as is necessary for making a distinct Picture of the Pin at one Distance, the Place where the distinct Picture of the other Pin is made, must fall short of, or beyond the *Retina*; and consequently, upon the *Retina* itself, the Picture must be confused, from which Confusion, Vision is rendred imperfect and indistinct; and therefore, since at Pleasure I can see distinctly either of the Pins I will, while at the same Time the other appears confused; it follows, that I have a Power of changing the Conformation of my Eye, and of adapting it to the different Distances of Objects; and this is the only Reason can be given, why Objects without Doors do not appear distinct through a Window-glass, when the Eye is attentive in observing the little Scratches or Particles of Dust upon the Surface of the Glass; and, on the contrary, when at-

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tentive to the external Objects; it does not distinctly observe the Scratches or opaque Particles of Dust upon the Glass; the Conformation of the Eye in the one Case being such as to paint distinctly upon the *Retina* the Images of the Scratches and Particles of Dust, but not to paint those of the external Objects but confusedly; and in the other Case, the Conformation of the Eye is adapted to paint exactly upon the *Retina* the Images of external Objects; and therefore the Place, where the distinct Images of the Scratches are made, must fall behind the *Retina*, from which they must appear confused and imperfect: And indeed, were it not for the Change that is made in the Disposition of the Eye, it were very difficult to explain how Birds, that dive in Pursuit of their Prey, should be enabled to see both in Air and Water, seeing the Refraction that happens in the Eye is so far different in the one Case from what it is in the other.

To weaken the Force of these Objections, *M. de la Hire* has Recourse to the Mobility of the *Pupil*, from which he endeavours to account for distinct Vision at all Distances, without any Change in the Conformation of the Eye; but with what Success will appear afterwards.

Having thus considered what *de la Hire* brings in support of his Hypothesis, I shall now proceed to some Experiments I made for measuring the Strength and Weakness of Sight; whereby not only the Fallacy of *de la Hire's* Reasoning will be made further manifest, but it will also be demonstrated, beyond all Exception, that our Eyes change their Conforma-

tion,

tion, and adapt themselves to the various Distances of Objects, within certain Limits; which Limits will also be accurately determined: But that these Experiments may be the better understood, I must first premise the following Axioms.

A X I O M . I.

When an Object, seen with both Eyes, appears double, by reason that its Distance is less than that to which the Eyes are directed, upon covering either of the Eyes, the Appearance that is on the contrary Side will vanish; and if it appear double, because its Distance is greater than that to which the Eyes are directed, upon covering either of the Eyes, the Appearance that is on the same Side will vanish.

Illustration. To illustrate this, see Fig. 3, 4 and 5, where A and B are the Eyes, x the Object, which is at a smaller Distance than the Point C, to which both Eyes are directed: It is evident, that while the Eyes continue directed to C, the Object x must be seen in two different Places, which, with respect to the *Horopter*, to which all Objects are referred, will be D and E; for being seen by the right Eye B, in the Direction of the visual Line BxD, it must, at D, hide a Part of the *Horopter* DCE; and being seen by the left Eye A, in the Direction of the visual Line Axe, it must hide a Part of the *Horopter* at E; and therefore, with respect to the *Horopter* on which the Eyes are fixed at C, the Object x must appear to the right Eye B, as at D, and to the left Eye A as at E; and, in covering either of the Eyes, the Appearance that

that is on the contrary Side will be made to vanish.

In like manner, if the Eyes are directed to x , the Object C, which is further off than x ; will be seen by the right Eye B, in the Direction of the visual Line BmC ; and by the left Eye A, it will be seen in the Direction of the visual Line AoC : And therefore, with respect to the *Horopter mxo*, to which all Objects are referred, it must appear double, as at m and o ; and in covering the right Eye B, the Appearance that is on the right Side towards m will vanish; and in covering the left Eye A, the Appearance that is on the left Side towards o will vanish; all which is exactly agreeable to Experience.

A X I O M II.

When an Object appears double, from its being seen with one Eye through two small Holes made in a Card, or any other opaque thin Body, if its Distance be greater than that to which the Eye is accommodated, upon covering either of the Holes, the Appearance that is on the same Side will be made to vanish; and if its Distance be less than that to which the Eye is accommodated, upon covering either of the Holes, the Appearance that is on the contrary Side will be made to vanish.

Illustration. Let E be the Eye, (See Fig. 6 and 7.) QT the Card, in which are two small Holes d and r , and let A be a small Body, at a greater or lesser Distance than that to which the Eye is accommodated: The Rays of Light Ad , Ar , will not, after Refraction, converge

verge to a Point in the *Retina*; but by reason that the Distance of the Object A is greater or less than that to which the Eye is accommodated, they will be made to converge to some other Point, either before or behind the *Retina*, such as o; but on the *Retina* itself they will fall on the different Points i and m, at both which a Picture of the Object will be formed; from which Duplication of the Picture, the Object itself will also appear double at C and B, *viz.* in the right Lines iC and mB, which are supposed to be drawn perpendicular to the *Retina* from the Points i and m, where the Pictures fall. Whence it is evident, that if the Hole at d be covered, there will be no Image at i, and consequently the Appearance at C will vanish; and if the Hole at r be covered, there will be no Image at m, and consequently the Appearance at B must vanish: But when the Object A is at a greater Distance than that to which the Eye is accommodated, as in *Fig. 6.* the Appearance that is made to vanish, by covering either of the Holes d or r, lies on the same Side with the covered Hole. But when the Object A is at a less Distance than that to which the Eye is accommodated, as in *Fig. 7.* the Appearance that is made to vanish lies on the contrary Side of the Hole that is covered, as has been affirmed in the Axiom.

Exper. 1st, I took a small Plate of white Iron IK, (*See Fig. 8.*) in which I had cut two parallel narrow Slits, whose Distance from one another did not exceed the Diameter of the Pupil. These Slits gave Passage to more Light than what could pass through small Holes, and therefore

therefore were fitter for my Purpose, it being necessary that the Object should be clearly seen.. This Plate I held close to my right Eye B, in such manner as the Slits might have a vertical Position; and having shut my left Eye A, through these Slits I viewed the small Object o, which also had a vertical Position, and consequently was parallel to the Slits. In this Experiment the Object o was at such a Distance from the Eye B, as to appear single, when viewed in this manner through the Slits: But when both Eyes were opened, and directed to a more distant Point, such as P, three Appearances were seen, a, b and c; which Appearances were nearer to, or further from each other, according as the Point P was nearer to, or further from the Object o, and in covering the left Eye A, the Appearance, a, that was on the contrary Side did vanish, which Appearance did therefore belong to the Eye A. And in covering the right Eye B, the Appearances on the contrary Side b and c, belonging to the Eye B, did vanish, from which I was certain that the Distance of the Object o was less than that to which the Eyes were directed, (*See Ax. 1.*) This being done, my next Business was to examine, whether these double Appearances b and c, that were seen thro' the Slits, did not also proceed from the Object o its being at a less Distance than that to which the Eye B was then accommodated, and upon Trial I found it was so; for by covering either of the Slits with my Finger, the Appearance on the contrary Side was always made to vanish, (*See Ax. 2.*) Having satisfied myself as to these Particulars,

culars, I changed the Direction of my Eyes, and turned both inwards towards a nearer Point, such as x , by which also three Appearances were seen, d , e and F , and these Appearances were also nearer to, or further from one another, according as the Point x was nearer to, or further from the Object o ; but they were always in a contrary Order to those that were seen, when my Eyes were directed as above: For the Appearance F , seen by the left Eye A , was on the left Side, and the Appearances d and e , which were seen through the Slits by the right Eye B , were on the right Side; whence I was certain, that the Distance of the Object o was greater than that to which my Eyes were directed. I then covered one of these Slits with one of my Fingers, and I found that the Appearance that was on the same Side did always vanish; from which, when compared, with the second Axiom, it follows, that the Object o is then at a greater Distance than that to which the Eye is accommodated.

In making this and all the following Experiments, it was necessary that the Object o should be as conspicuous as possible: What upon Trial I found to answer best, was a narrow Slit made in a dark Lantern in which a lighted Candle was put, to render it luminous, though sometimes I also made use of a black Line upon white Paper, or a white Line upon black Paper, both which answered very well, in all the Experiments wherein the Distance of the Object did not exceed two Feet; but when the Distance was greater, these Lines began to be obscure, and by reason of their Obscurity, the Experiment did not succeed so well. It must also be observed here, once for all,

that tho' in the above Experiment, it was easy for me to direct my Eyes to a Distance that was either greater or less than the Distance off the Object o, without the Assistance of any other Object, on which my Eyes might be fix'd; yet in this, as well as in many of the subsequent Experiments, I was sometimes obliged to put an Object in that Place, towards which both Eyes were to be directed; and this was always necessary, either when a great Effort was needful to give the Eyes the designed Direction; or when, for observing the Phænomena more accurately, the Experiment required that the Eyes should for some Time be kept fixed in a certain determined Direction, both which are made much easier, by having an Object on which the Eyes may be fix'd. When it was required that my Eyes should be directed, to a very near Distance, for the Object o I made use of a black or white Line, made on Paper of an opposite Colour; and at the Place x, to which my Eyes were to be directed, I held in a horizontal Position, and parallel to my Eyes, any small Object zx, such as a bit of the Stem of a Quill, whose Extremity x, I look'd at for an Object; but when the Experiments required that my Eyes should be directed to some Point at a considerable Distance beyond the Object o; for the Object o I made use of the narrow Slit in the Lantern, and at the distant Point P, to which my Eyes were to be directed, I placed another dark Lantern, in which was the horizontal Slit PQ, whose Extremity P, which was seen by the right Eye, in the visual Line BOP that pass'd immediately above the upper

per End of the Object o, served me as a Point of View, on which I could easily fix both Eyes, while I attended to the Appearance of the Object o.

Now from this Experiment, compared with the preceding Axioms, it clearly follows, *1mo*, That we are possessed of a Power of changing the Conformation of our Eyes, and of adapting them to various Distances: *2do*, This Change in our Eyes, whereby they are fitted for seeing distinctly at different Distances, does always follow a similar Motion in the Axes of Vision with which it has been connected by Use and Custom; for when the Eyes were directed to P, the Object o was seen double through the Slits; and by covering one of the Slits, it appeared that the Eye was adapted to too great a Distance; and as the Point P was brought nearer and nearer the Object o, these Appearances approached nearer and nearer to one another continually, till at last, when the Point P became very nigh to o, they coincided in one at o, which shews that the Eye was then adapted to its Distance. But when the Point P was moved along the Line ox from o to x two Appearances of the Object o were again seen through the Slits; which Appearances being in a contrary Order from what were seen, when the Point P was on the other Side of the Object o, it follows that the Eye was then adapted to too small a Distance. And as the Point P, in its Motion from o to x, receded further and further from o, these Appearances receded further and further from one another continually. From all which it is very evident, that there is a necessary Connection and Dependence established

betwixt those Motions, whereby the Conformation of our Eyes is changed, and certain corresponding Motions in the Axes of Vision, which makes it impossible for us to direct our Eyes to any Object, within the Limits of distinct Vision, without at the same Time giving them that Disposition that is necessary for seeing distinctly at that Distance; but these two Corollaries will be still further confirmed by the Experiments that follow.

Exper. 2. The Distance of the Object o (Fig. 8.) being five Inches, I viewed it through the Slits, the other Eye A being shut or covered, and it appeared double; and upon covering either of the Slits, the Appearance that was on the contrary Side was made to vanish, and therefore the Distance of the Object was less than that to which the Eye was accommodated; and both Eyes being open, and directed to x, whose Distance from the Eye was about three or four Inches, three Appearances were seen, d, e and F, whereof the Appearances d and e belonged to the right Eye B, and when with my Finger I covered either of the Slits, the Appearance that was on the contrary Side did vanish; whence it is evident, that I cannot, by any Effort, fit my Eyes to so small a Distance as five Inches.

Exper. 3, 4 and 5. At six, seven and eight Inches Distance, when one Eye was shut, the Object o, seen through the Slits, appeared double; and by covering one of the Slits, it was evident that its Distance was less than that to which the Eye was accommodated. And in looking with both Eyes to x, whose Distance from

from the Eye was about half the Distance of the Object o, a double Appearance was seen, one at F belonging to the Eye A, and the other at x belonging to the Eye B, but this Appearance at x was always single, though seen through the Slits; whence it follows, that my Eye cannot accomodate itself to a Distance that is much less than six, seven or eight Inches.

Exper. 6. At the Distance of nine Inches, the Object o seen through the Slits, the other Eye being shut, appeared sometimes single, but mostly double; and when it appeared double, it was evident, by covering either of the Slits, that it was too near, with regard to the Disposition of the Eye; and when both Eyes were open, and directed to the Quill x, which was at half Distance precisely, three Appearances were seen, whereof the Appearances d and e did belong to the right Eye B, to which the Slits were applied; and in covering one of those Slits, the Object on the same Side disappeared: Whence I was certain that the Object was too far off, and that my Eye can be accommodated to a less Distance than nine Inches, but not much, as may be learned from the Nearness of the Appearances, as well as from the four last Experiments.

From the five last Experiments laid together, we may safely draw the following *Corollary*, viz. The nearest Limits of distinct Vision, in my Eyes, is at about seven Inches Distance; for by the second Experiment it appears, that my Eyes cannot be fitted to so small a Distance as five Inches; and by the last Experiment it is plain, that they can be accommodated to a less

Distance than nine Inches; and the third, fourth and fifth Experiments make it manifest, that at six, seven and eight Inches Distance, the Object seen through the Slits appears always single, whatever Effort be made to double it, by straining the Eyes to see a nearer Object; whence the middle Distance, seven Inches, seems to be nearly the nearest Limits of my Eye, beyond which it cannot go: And therefore all Objects, that are nearer than seven Inches, must appear more and more confused, according as their Distance is less and less than seven Inches.

Exper. 7. In looking to an Object at two Feet Distance, through the Slits, the other Eye being shut, it always appeared double and too far off; and in looking with both Eyes to a more distant Object, it was then also seen double; but in covering either of the Slits, the Appearance on the opposite Side did vanish; whence it was evident, that the Object was then too nigh, but these Appearances were so close, that they did almost touch one another; which shews that my Eyes can scarce go further than to accommodate themselves to the Distance of two Feet.

Exper. 8. At two Feet and a half, three Feet, and all greater Distances, the Object not only appeared double and too far off, when viewed with one Eye through the Slits; but when both Eyes were open, and directed to a very distant Object, the double Appearance that was then seen through the Slits, was such, as by covering one of the Slits, made it evident, that even then the Object was also too far off; from which it follows, that my Eyes can never, by any

any Effort; be accommodated to so great a Distance as two Feet and a half.

Corol. From this and the immediately preceding Experiment, it seems probable, that the furthest Limits of my Sight reaches to the Distance of about twenty seven Inches: For by *Exper. 7.* it is plain that I can accommodate my Eye to a Distance that is greater than two Feet; and by the last Experiment it is manifest, that my Eye cannot accommodate itself to so great a Distance as two Feet and a half: Whence it seems reasonable to conclude, that the furthest Limits of my Sight lies about the middle Distance betwixt both.

Exper. 9 and *10.* At ten and twelve Inches Distance, the Object o, seen with one Eye through the Slits, did, as in the 6th *Exper.* where it was at the Distance of nine Inches, appear sometimes single, but frequently double and too nigh.

Exper. 11 and *12.* At the Distance of fifteen and eighteen Inches, one Eye being shut, the Object o, seen through the Slits, appeared sometimes single, and at other Times double; but when it was double, by covering one of the Slits, it was always found to be too far off.

Corol. From the four last, as well as from some of the preceding Experiments, it is manifest, *imo,* That the Eye does frequently mistake the Distance of the Object seen through the Slits; for when its Distance lies betwixt the Limits of distinct Vision, to which the Eye can easily accommodate itself, it would never appear double, did not the Mind mistake its Distance. And this is the Reason why, when both

both Eyes are open, and directed to the Object, it appears single at all Distances within the Limits of distinct Vision, by reason the Eye is then accommodated to its Distance, which is then known to us, by means of the Angle which the optick Axes make at the Object. 2d^o, The Judgment which the Mind forms with respect to the Distance of Objects, seen with only one Eye through the Slits, is not always the same, but is fluctuating and inconstant, as may be gathered from the four last Experiments, where the Object sometimes appeared single, and at other Times double; and when it appeared double, the Distance betwixt the Appearances was not constantly the same. 3d^o, If the Object seen through the Slits, the other Eye being shut, is not much beyond the nearest Limits of distinct Vision, when the Mind mistakes its Distance, it imagines it further off than it really is, as is evident from the 4th, 5th, 6th, 9th and 10th Experiments. But 4to, When the Object is not a great deal nearer than the furthest Limits of distinct Vision, when we mistake its Distance, we imagine it nearer than it really is; whence it appears double, because it is too far off with respect to the Conformation of the Eye, as does appear from the 7th, 11th and 12th Experiments.

If it should be here enquired, why the Mind mistakes the Distance of the Object seen through the Slits, the other Eye being shut? To this I answer, that by running over all the Means, the Mind can possibly employ for judging of the Distance of Objects, which Means we will have Occasion to touch upon below, it will appear that

that in the Case before us, we can scarce form any Judgment with respect to Distance, but what is entirely founded upon Prejudice and Anticipation; and therefore it needs be no Wonder that we are frequently led into Error and Mistake, and that the Mind should be so fluctuating and inconstant in the Judgments it forms of Distance.

When I made the foregoing Experiments, I designed to repeat them with more Care and Exactness, and to make some new ones of the same Sort, by means of an Instrument I had contrived for that Purpose; which from its Use in measuring the Limits of distinct Vision, and in determining with great Exactness the Strength and Weakness of Sight, may be called an *Optometer*: But I was then interrupted, and I have not now Time to take those Things into further Consideration.

Having thus sufficiently demonstrated, that our Eyes do change their Conformation, and adapt themselves to the different Distances of Objects, it remains that we examine wherein this Change consists, and by what Mechanism it is introduced, about which Authors are very much divided in their Opinions: The chief of which we shall now consider, and fix upon what we think most probable, leaving every body at Liberty to differ from us as he sees Reason.

Some are of Opinion, that the whole Globe changes its Figure, by being lengthened into an oblong Figure when Objects are near, and by becoming flat when they are removed to a greater Distance. This indeed very well accounts

counts for the distinct Appearance of Objects at different Distances; for according as Objects are nearer or further from our Eyes, their Images will be painted at different Distances behind the crystalline Humour: And therefore, if we have a Power of rendering the Eye flat or oblong, the *Retina* will be brought to that precise Place behind the Crystalline, where the perfect Image of the Object is made, and consequently will be seen distinctly.

Now this Change in the Figure of the Eye is differently explained by Authors. Some maintain, that it is rendered oblong by the joint Contraction of the two oblique Muscles; and this Opinion Dr. Keill likewise embraces: His Words are, “The aqueous Humour being the thinnest and most liquid, easily changes its Figure, when either the *Ligamentum Ciliare* contracts, or both the oblique Muscles squeeze the Middle of the Bulb of the Eye, to render it oblong when Objects are too near us.” (See his *Anat. Chap. iv. Sect. 4.*) But this is by no means probable; for in order that the Eye may be rendered oblong by the Contraction of these Muscles, it is necessary to suppose, that they press its Sides inward towards its Axis; but this they cannot perform, because their Disposition is not proper for that Effect: Had they been so disposed, as to embrace the Globe in the Form of a Ring, their Contraction might then have squeezed the Eye into an oblong Figure; but their present Disposition is very far different from what seems necessary for producing this Change in the Eye; which we shall not now repeat, having in the former

Part

Part of this Essay described them at some Length. But besides this, there is yet another Argument against the Eye's changing its Conformation, when these Muscles contract; and that is, that in several Creatures their Disposition is very far different from what it is in Man: Thus in the *Pike*, they are both situated in the under Side of the Eye, where they decussate one another in Form of a Cross, as has been observed from *Aquapendente* and *Perrault*, in the former Part of this Essay. In the *Canis Carcharias*, and in some other Fishes of the Dog Kind, *Steno* has observed, that the *Superior oblique* had no *Trochlea*, but that its Origin and Progress was altogether similar to the *Inferior oblique*, (See his *Canis Carchariæ disjectum caput*, and his *Dissectio piscis ex canum genere*.) And *Peierus* the Son, in his *Observationes Anatomicæ*, tells us, that the *Grand oblique* is also without any *Trochlea*, both in Geese and Hares; whence it seems very improbable, that these Muscles, so differently disposed in different Animals, do ever squeeze the Eye, so as to render it oblong; and yet it must be allowed, that they have a Power of accommodating their Eyes to the different Distances of Objects, as well as other Creatures, which therefore must be sought for somewhere else, than in the *oblique Muscles*.

Another Opinion concerning this Change of our Eyes is, that the four *straight Muscles*, acting together, compress the Sides of the Globe, and, by this Compression, reduce it to an oblong Figure, when Objects are near; and that by its natural Elasticity it recovers its former Figure,

Figure, when these Muscles cease to act; but though this Opinion be received by the learned Boerhaave, as well as by the Generality of other Authors, yet there are many Objections, which render it very doubtful, if not altogether absurd: For when these Muscles act together, they must draw the Eye inwards, and press its Bottom against the Fat, which touches it in that Place: But all Action and Re-action being equal, it follows that the back Part of the Eye must be pressed forewards by the Fat with as much Force as the Muscles draw the Eye inwards; and consequently, that the Force whereby these Muscles endeavour to lengthen the Eye, by compressing or squeezing its Sides, must be ballanced and taken off, by the Pressure of the Fat, against the back Part of the Eye. The other Objections against this Hypothesis, must be taken notice of below, to which the Reader must therefore be referred, for saying Repetitions.

Others again are of a quite contrary Opinion, and would perswade us, that when these four streight Muscles act together, they render the Eye flat, by pulling it inwards, and pressing its Bottom against the Fat; and that it is again reduced to its former Figure, either by the joint Contraction of the two oblique Muscles, or by the inherent Elasticity of its Parts, which exerts itself when the Streight Muscles cease to act: But neither does this Opinion appear probable; for when these Muscles contract, they not only endeavour, by pressing the Eye against the Fat in the Bottom of the Orbit, to render it flat, but likewise squeeze the Sides of the Eye, and

and by that means endeavour at the same time to render it oblong, which two Actions being equal, because proportional to the same Cause, viz. the Contraction of the Muscles, and being contrary to one another, they must destroy each other.

From what has been said, it seems very probable, that the Eye can neither become flat nor oblong, either by the Action of the *Streight* or *Oblique* Muscles. And this does yet further appear from the following Reasons. 1^o, Did the Eye accommodate itself to the Distance of Objects, by any Change in its Figure arising from the Contraction of its Muscles, this Change would be different in different Positions of the Eye, and only regular in one Situation of it.

2^o, If you press your Eye gently with your Finger, all Objects seen with that Eye will appear confused and indistinct, neither will they appear more perfect, at whatever Distance they be placed. If you ask the Reason of this Phænomenon, I know no better Answer, than that that determined Situation of the small Fibres composing the *Retina*, which is necessary for distinct Vision, is by the Pressure of the Finger disturbed and disordered: And therefore, it is not easy to understand, how the same Disposition should not be equally disordered by that supposed Compression of the Muscles, which is necessary for changing the Figure of the Eye.

3^o, A third Argument against this Change of Figure in the Eye, is, that in some Creatures the *Sclerotica* is so very hard as does not allow of any such Change; and this Disposition in the *Sclerotica* is generally observable in all Birds

Birds and Fishes, both which have it bony, from the middle of the Globe, to its fore Part, where it joins the *Cornea*, as has been observed by *Aquapendente*, the *French Academists*, and many other Anatomists. Mr. *Ranby* has observed, that this bony Circle in the *Ostrich* consists of fifteen bony Scales joined to one another, so as to make one circular Bone round the *Cornea*, of which he has given a Figure in the *Philosophical Transactions*. And Mr. *Warren* has since found, that the *Ostrich* has this Ring in common with other Fowls both of the Water and Land, with this Difference only, that the Ring in Water-Fowls consists of fifteen, and in Land-Fowls but of fourteen Bones, and that they are so disposed, that one Bone lies over the Ends of two others, then three or four ly over one another like the Scales of Fish; then one Bone lies under the Ends of two others, and then two or three more follow again like the Scales of Fish; but he thinks, that unless there be a *lusus naturæ*, Mr. *Ranby*'s Figure does not express it so very justly as it might be done, which *Ranby* himself in another Paper seems to acknowledge, (See *Philosoph. Transf. abrid. Vol. VI.*) But whatever be in this, one Thing is certain, that in all Fowls, as well as Fishes, a great Part of the *Sclerotis* is hard and inflexible: And particularly in the *Owl*, Mr. *Perrault* speaks as if it were wholly bony, yet I find, that *Peierus* the Son makes it a little softer towards the Entry of the optick Nerve. But what makes most for our Purpose, is, that in some Fishes the whole of the *Sclerotica* is of a cartilaginous or bony Substance; thus;

thus it is in the Whale, in which also its Thickness is more than an Inch, as *Ruyfch* observes, *Thesaur. anatōm. maxim. N. LI.*) In the Sea-Fox, this Tunicle, tho' thin, was by the French Academists found "so hard that it might rather pass for a Bone than a Cartilage," (See their *Memoirs for the natural History of Animals.*) And the like has been observed by *Steno*, in the *Canis Carcharias*, and some other Fishes of the Canine Kind, *Sclerodis tunicæ pars anterior, & translucens*, (says he in his *Canis carchariæ dissecatum caput*) quæ cornea dicitur, hīc plana erat, reliqua pars verè dura, cæteris in eodem pisce cartilaginibus similis ; sic & in avibus, magna sclerodis pars ossea reperitur, &c. *Santorini*, in his *Observationes anatomicæ, cap. IV. sect. 2.* has also a very remarkable Observation to this Purpose : His Words are, *Quoniam nulla sunt, quæ circa oculi musculos adnotanda habemus, de eorundem usu quædam proponere libet : num scilicet, præter ejusdem oculi motum illum sic vel retrahant vel producant, ut vel in planiorem, vel in acutiorem figuram ille conformetur ? Hanc me in quæstionem induxit osseam prorsus reperiisse in Thinni oculis sclerotidem membranam, ob cujus quidem soliditatem ac duritatem, nullo muscularum vel valentissimo nisu constituta potest figura commutari. Quapropter si in eo pisce quidquam commodi ex ejus figuræ varietate natura speravisset, aliud quodpiam artificium in ejus vicem machinata fuisset, &c.* Now from these Observations it is very plain, that in many Animals it is impossible that the Eye can accommodate itself to the different Distance of Objects, by varying its

Figure, the Action of its Muscles being insufficient to overcome the Resistance of its cartilaginous or bony and almost inflexible Tunicles; and yet it cannot be denied but they have a Faculty of changing the Conformation of their Eyes, and of adapting them to the Distance of Objects, as well as other Creatures, which therefore we must expect to find somewhere else than in any of its Muscles.

It may indeed be said, that though the Change, made in the Eyes of Birds and Fishes, does not proceed from the Action of its Muscles, yet it does not from thence follow, that in Man and other Animals, who have the Tunicles of the Eye flexible and yielding, the Contraction of these Muscles does not produce some Variation in the Figure of the Eye: This I readily own; yet if we consider, that Nature is very consonant and conformable to herself in all her Actions, we can hardly doubt but the same Cause, which in Fishes and Birds, accommodates their Eyes to the distinct Vision of Objects at different Distances, does likewise produce the same Change in the Eyes of Men, especially since there is nothing to be found in the Eyes of these Creatures, capable of producing that Change, but what also obtains in human Eyes.

I am not ignorant, that some have feigned certain Fibres going from the *Choroides* to the Crystalline in Birds; and others have supposed, that in Fishes there is likewise some peculiar Disposition for adapting their Eyes to the Distances of Objects. But with respect to Birds, *Perrault*, and the French Academists have particularly

ticularly observed, that there is no such Fibres different from those that compose the *Marsupium nigrum*, which can never answer that End, being adapted to another Purpose, to be explained afterwards ; and as for Fishes, that pretended Mechanism is so darkly explained, and that only by Authors of so little Character and Reputation, that it does not deserve Credit. But,

4to, To put this Matter out of all Dispute, we must have Recourse to the following Observation, viz. A Man having a Cataract in both Eyes, which intirely deprived him of Sight, committed himself to an Oculist, who finding them ripe, performed the Operation, and couched the Cataracts with all the Success could be desired ; but after they were couched, he could not distinctly see Objects, even at an ordinary Distance, without the Help of a very convex Lens ; which is what every Body has observed to be necessary to all those who have had a Cataract couched : Neither is the Reason thereof difficult ; for as a Cataract is not a Philm swimming in the *aqueous Humour*, as has been generally believed till of late, but an Opacity in the Crystalline itself ; and as the couching of a Cataract consists in introducing a Needle into the Eye, and turning down that opaque Humour below the Pupil, it is evident that the Crystalline cannot be displaced and turned down to the under Part of the Eye, but the vitrous Humour must, in giving way to it, be pushed into its Place ; but because its Density is less than that of the Crystalline, it follows, that the Rays of Light will be less refracted, and therefore

fore will not meet at a Point in the *Retina*, but at some Distance behind it; from whence the Sight must be confused, unless a convex Glass, of a due Degree of Convexity, be brought to Assistance, which, by refracting the Light, may render its Rays more converging, and thus supply that Refraction which is wanting in the Eye by the Depression of the Crystalline; and this is the true Reason why there can be no distinct Vision after the couching of a Cataract, unless when Objects are viewed through a convex Glass of a due Degree of Convexity; nor has the Efflux of the aqueous Humour any Concern in this Phænomenon, seeing it is again restored, as was known to *Galen*; but this is not all that happens after the Depression of the Cataract; for it was observed, that the same *Lens* was not equally useful for seeing all Objects distinctly, but that he was obliged, for seeing them distinctly, to use Glasses of different Degrees of Convexity, still the more convex the nearer the Object.

To make this Experiment with great Exactness and to provide against all Possibility of Mistake, it were proper to cover that Side of the *Lens* which is next to the Eye, with black Paper, in the middle of which, two narrow parallel Slits have been made, whose Distance from one another does not exceed the Diameter of the *Pupil*. By this Means, if the Eye still retains its Faculty of changing its Conformation, a small Object, that is at such a Distance as to appear single through the Slits, when the other Eye is shut, may be made to appear double, by opening both Eyes, and directing them to a nearer

nearer or more remote Object, as has been explained above; whence, if no such double Appearance can be seen, we may conclude with great Certainty, that the Eye has lost its Power of accommodating itself to the Distance of Objects. I have never had an Opportunity of making the above Experiment my self; but when any such offers, I design to make it in this Manner, or rather to employ the Instrument formerly mentioned; which, for its Use in measuring the Limits of distinct Vision, and in determining with the utmost Exactness the Strength and Weakness of Sight, I have called an *Optometer*. In the mean time, from the Experiment as it stands, we may safely draw the following Corollaries.

Cor. 1. From what happens in couching the Cataract, the Eye loses the Faculty of adapting itself to the various Distances of Objects.

Cor. 2. Did that Change in the Eye, that is necessary for seeing Objects at different Distances, depend upon the Action of its Muscles, then after the Depression of a Cataract, the same *Lens* will answer all Objects of whatever Distance; but since this not Fact, it follows, that however the Muscles of the Eye may be supposed to change a little its Figure, yet this Change is not sufficient to provide for the distinct Vision of Objects at all Distances.

Cor. 3. Seeing that nothing happens in the Eye, in couching the Cataract, but that the Crystalline is depress'd, it follows that the Change made in our Eyes, according to the Distance of Objects, must be attributed to this Humour.

It remains now that we enquire what this Change of the Crystalline is, and by what Mechanism it is produced.

Some maintain, that according as Objects are at different Distances, this Humour becomes more or less convex, which does indeed very well account for distinct Vision at all Distances; for Objects painted on a Sheet of white Paper, by means of a *Lens* plac'd in the Hole of a Window-shut of a dark Chamber, have their Images always distinct at whatever Distance they be from the Window, provided that the *Lens* be of a Convexity answerable to that Distance.

Others again are of Opinion, that the *Crystalline* never changes its Figure, but that it is moved to and from the *Retina*, according to the Distance or Proximity of the Object in View; and this also does equally well account for the distinct Appearance of Objects at all Distances, as is evident from the Laws of Opticks, as well as from the vulgar Experiment of casting the Species of Objects from abroad, upon a Sheet of white Paper, by means of a *Lens* plac'd at a Hole in the Window-shut of a dark Chamber: For the Picture will always be distinct, at whatever Distance the Object may be, provided that the Paper be at a due focal Distance behind the *Lens*.

Those that embrace the first Opinion say, that the *ligamentum ciliare*, which arises all round from the Inside of that Circle of the *Choroides* where it joins the *Uvea*, does by its Contraction draw the Edge of the Crystalline, to which it is attach'd all round, towards that

Circle

Circle ; and by that means makes it broader and flatter than before, when Objects are at a Distance from the Eye ; and that when we view nearer Objects, this Ligament is relax'd, and the Crystalline recovers its Convexity by the Elasticity of its Parts : And to render this Opinion still the more probable, they contend that it is for this End that Nature has made the outer Part of this Humour of a Substance easily flexible and yielding, that it may with greater Facility yield to the Contraction of this Ligament. But if we observe accurately the Situation of the *ligamentum ciliare*, we will find that it is such as disqualifies it for rendering the Crystalline more flat, by increasing its Breadth ; for its Fibres are not in the same Plane with the Crystalline, but have an oblique Direction, as in Fig. 9. where C is the crystalline Humour, aCa its transverse Diameter, aa , ao the *ligamentum ciliare* (sometimes also called the *ciliary Process*.) Now in order to draw out the Crystalline into a broad flat Figure, or which is a juster way of conceiving this Matter, in order to draw out and extend its Capsule, so as it may compress the Crystalline into this Figure, it seems necessary it should be drawn according to the Direction of the Lines, ab and ab which are in the same Plane with the transverse Diameter of this Humour aCa ; but this can't be performed by the *ligamentum ciliare*, because its Direction is oblique ; and therefore it can never by its Contraction change the Figure of the Crystalline. Nor is this Opinion rendered more probable from the different Substances of which the Crystalline is composed :

It is indeed true, and has been observed by Anatomists, that though this Humour be all very solid, in respect of the other Humours of the Eye; yet it is not all throughout of the same Consistence, being externally like a thick Gel-ly, but internally, towards its Center, of a Consistence equal to that of hard Sewet: This external soft Part of the Crystalline is by some reckoned to be about the Third of its whole Bulk; and, in Fishes, this Difference of Consistency is in a particular Manner remarkable, who are therefore said to have a double Crystalline, the one very small and solid, in the Center of the other, which is larger, but of a softer and less solid Substance. This little Crystalline, which is as it were a *Nucleus* or Kernel to the other in whose Center it is placed, is never found wanting in the Eyes of Fishes; and indeed in all Animals, so far as has been observed, this Humour is always much softer externally than towards its Center. But it does not from this follow, that Nature has thus softened the external Part of this Humour, that its Figure may be the more readily varied for seeing distinctly at all Distances, but for another very wise and necessary Purpose: For it is certain that the Rays of Light which fall upon the Extremities of the Crystalline, by reason of their greater Obliquity, must be more refracted than those which fall upon its Middle, near its Axis, by which means they will be made to meet at different Distances behind the crystalline Humour, these towards its Extremity nearer, and these near its Axis at a greater Distance; so that it is impossible for all to be united exactly upon the

the *Retina*, for rendering the Sight distinct : And therefore, to prevent this Inconveniency, provident Nature, which is never known to do any Thing in vain, but always for the best Purposes, has very wisely, towards the Center of the Crystalline, made its Substance more dense and solid ; that the Rays of Light that fall on the Crystalline; near its Axis, may, in passing this *Nucleus*, have their Refraction increas'd, and by that means may be made to converge, and meet at the same Point with those that pass the Crystalline towards its Edge or Extremity.

This is the Reason why the Crystalline of all Animals is more solid in its Center than externally, and why in Fishes this Difference is so remarkable ; for in them this Humour being spherical, as has been observed above, the Rays that fall thereon, at some Distance from its Axis, by reason of their great Obliquity, would be made to meet at a greater Distance from the Point of Union of the other Rays that pass near its Center, than in Land-Animals who have this Humour lenticular ; and therefore, to prevent this Inconveniency, which would have rendered the Sight prodigiously indistinct, Nature has provided them with that small solid Crystalline in the Center of the other, whose Density far exceeds that of the *Nucleus* of Land-Animals.

All this might be demonstrated mathematically ; but if a Glass Lens be covered with opaque Paper in which there are two Holes, one at the Axis of the Glass, and another towards its Edge, and if this Glass be plac'd in the Hole of the Window-shut of a dark Room, so as to refract a Beam of the Sun's Light upon a Sheet of

of white Paper, plac'd at a due focal Distance behind the Lens, it will be found that the Beam that passeth the Hole towards the Edge of the Lens, will cut the *Axis* before the *Focus* of the Glass, and fall on the opposite Side of the Paper. From all which it is evident, that the different Consistency observable in the crystalline Humours, does not prove that they are rendered flatter by the Contraction of the *ciliary Process*, as some Authors would persuade us, but to diminish the Refraction where the Rays fall most obliquely, and thereby to dispose them to meet in the same Point with those which pass through its Middle, which was absolutely necessary for distinct Vision, unless the Pupil had been much less than it now is, in which Case our Sight had not been near so clear as it is at present. If it should be said, that the Crystalline changes its Conformation, and becomes more or less convex, by the Action of certain muscular Fibres that enter its Composition, it is incumbent on those who entertain this Opinion to shew us these Fibres. The Crystalline, when dry'd, doth manifestly enough appear to be made up of many thin concentrical *Laminæ* or Scales lying one upon another, of which Mr. Lewenhoeck reckons there may be 2000 in one Crystalline from the Outermost to the Center, and every one of these Scales, he saith, he hath discovered to be made up of one single Fibre, or finest Thread, wound in a most stupenduous Manner this way and that way, so as to run several Courses, and meet in as many Centers, and yet not to interfere or cross one another in any one Place. In *Oxen, Sheep, Hogs, Dogs* and

and *Cats*, the Thread spreads into three several Courses, and makes as many Centers; in *Whales* five, but in *Hares* and *Rabbits* only two; in the whole Surface of an *Ox's* Crystalline, he reckons there are more than 12000 Fibres juxtaposed. But for the better understanding the Manner of this admirable Piece of Mechanism, I must refer to the Cuts and Descriptions in his Works, and in the *Philosophical Transactions*, num. 165 and 293, from which it will appear that this Disposition is but ill qualified for changing the Figure of the Crystalline, and for adapting it to the Distance of Objects. But supposing it were otherwise, and that it could be made appear that the Disposition is well fitted for that Effect, I am afraid it would not be so easy to prove those Fibres to be muscular, and capable of Contraction.

There is yet another Argument against this Hypothesis of the *Crystalline's* changing its Figure, by means of muscular Fibres that enter its Composition, which must not be omitted; and that is, that it has no visible Attachment or Communication with any Part of the Body, but is kept in its Place by means of a *membra-nous Capsule*, with which it has not the least Connexion; whence it is, that when this *Capsule* is opened, the Crystalline escapes of itself without the least Violence, as has been observed by *Maitre-Jean* in his *Maladies de l'œil*, chap. xi. and by *Dr. Petit* in the *Memoires de l'Academie Royale* an. 1730, who therefore make no Scruple to affirm, that of all the Parts of our Body, the Crystalline is the only one that has no Continuity with the Parts adjacent, by any

any Fibre, Blood-vessel or Nerve : And this Opinion is very much strengthened by a Passage I find in Steno's *canis carchariæ dissectum caput.* Crystallini humoris propria tunica contenti (says he, speaking of this Animal) *substantia triplex erat, intima, centrum, centroque vicina loca occupans, dura, & ex lamellis composita erat,, quæ integræ, crystalli instar, diaphanæ apparebant, sectæ verò, albæ simul & opacæ evadabant ; extima crystallini substantia, tunicæ proxima, aquæ instar diffuebat ; reliqua, ut centrum inter & tunicam, medium locum innenerat, sic etiam consistentiæ medie erat, visciditate suâ gluten æmulans.' Solidus globus viscoso suo circumdatus liberè in aqua volvebatur.* From these Words it is plain, that the Author, who was one of the most accurate Anatomists in his Time, discovered no Attachment of the Crystalline to its Membrane or Capsule, which, had there been any, could not easily have escaped his Observation, where so much Water surrounded the solid Crystalline ; and this will be still more evident, if we consider the following Passage, from which it appears that he had frequent Opportunities of repeating the like Observations. See his *dissectio piscis ex canum genere*, where, speaking of the Crystalline in one of those canine Fishes, he says, *Crystallini humoris substantia triplex erat ; media dura, & ex lamellis composita ; huic undique adhærens alia multum glutinosa ; tertia tunicæ proxima, omnino aquæa, sed & hoc piscibus aliis plurimis datum est.*

The famous Morgagni has also observed, that there is Water in the Capsule of the Crystalline,

not only in Men, but in several other Creatures, (*Adversar. vi. p. 90.*) and yet he takes no Notice of any Attachment. But of all the Authors that have written on this Subject, Dr. *Petit* seems to have carried his Observations the furthest ; for he found this Water not only in the human Eyes, but in the Eyes of *Dogs*, *Cats*, *Wolves*, *Hares*, *Rabbits*, *Sheep*, *Lambs*, *Calves*, *Oxen*, *Horses*, *Turkies*, *Ducks*, &c. but could never discover the least Attachment, though he seems to have been at a good deal of Pains in searching after it. See *les Memoires de l' Academie Royale an. 1730.*

Had the *Crystalline* any Continuity with its *Capsule*, it is probable that *Ruyſch's* subtle Injections would have reached it ; but we find he could never go further than its Membrane, and that only by pushing forward the Blood in its Vessels by the ceraceous Matter, from which they became conspicuous, though the ceraceous Matter itself could never be made to enter them, (*Ruyſch. Thesaur. 2. locul. arc. 4*) Seeing then that the *Crystalline* has no visible Attachment or Communication with any Part of the Body, it can never receive into its Fibres any Blood or Spirits ; and consequently it cannot be adapted to the Distance of Objects by the Contraction of those Fibres.

If any body should ask me, how it is possible for the *Crystalline* to be nourished, without having some Communication with the neighbouring Parts, from which it may derive Blood and Spirits ? To this I answer, That I see no Absurdity in giving it a kind of vegetative Life, and in supposing that it draws Nourishment

from the Water in which it fluctuates, as *Maitre-Jean* and *Petit* have supposed ; and this may be the Reason, whence it is that when this Water is wanting, as sometimes happens in morbid Cases, the *Crystalline* becomes dry and opack, much like what it is when taken out of the Eye and dried, as *Brisseau*, *Morgagni* and *Petit* have observed.

The last Opinion concerning the Change made in our Eyes, is what we embrace, and consists in the Motion of the *Crystalline*, whereby the Distance betwixt it and the *Retina* is increased or diminished according to the different Distances of Objects ; so that at whatever Distance Objects are placed, the *Retina* is always at a due focal Distance behind the *Crystalline*.

Now the *Ligamentum ciliare* is an Organ whose Structure and Disposition excellently qualify it for changing the Situation of the *Crystalline*, and removing it to a greater Distance from the *Retina*, when Objects are too near us ; for when it contracts, it will not only draw the *Crystalline* forwards, but it will also compress the vitrous Humour lying behind it, by which Compression it must press upon the *Crystalline*, and push it forwards further from the *Retina* : For understanding which, let C (Fig. 9.) be the *Crystalline*, and let the curve Lines *ao*, *ao* represent the *Ligamentum ciliare* ; it is easy to see that when this Ligament contracts, it must draw the *Crystalline* forwards in the Direction of the right Lines *aod*, *aod*, by which means this Humour will be brought nearer the Fore-part of the Eye *oo* : But this is not all, for the Fibres, composing this *Ligament* or *muscular Pro-*

Process, do not run in a straight Line from their Origin in the *Choroides* to their Insertion in the Edge of the *Crystalline*, but by their Inflection form a Hollow, behind which lies the vitrous Humour, as represented in the Figure; and therefore when they contract, they must come nearer to the straight Lines *ao*, *ao*, by which means this Concavity will become less, and the vitrous Humour will be compress'd; which therefore must, by pressing on the Back of the Crystalline, push it forwards further from the *Retina*, when we look at near Objects, its Axis all this while remaining the same.

Plempius ascribes the Discovery of the Use of this *Ligament*, in changing the Conformation of our Eyes, to the celebrated Philosopher and Mathematician *Johannes Keplerus* of which Anatomists need not be ashamed, it being only from mathematical Principles that the Necessity of any such Change was ever discovered. But in explaining this Matter, not only *Kepler*, but *Plempius* himself seems to have fallen into a Mistake; for they suppose that, by the Contraction of this Process, the Sides of the Eye are drawn inwards towards the *Crystalline*, by which means the Eye is elongated, and the *Retina* is push'd back to a greater Distance behind the *Crystalline* when Objects are near; which is repugnant to the above-noticed Situation of this Process, as well as to the Hardness and Inflexibility of the *Sclerotis* of several Animals. See *Plemp. Ophthalmogr. lib. iii. cap. 9.*

M. de la Hire denies this Motion of the Crystalline, as well as all other Changes made in the Conformation of the Eye, all whose Argu-

ments have already been examined at some length, excepting those taken from the Structure of the Parts ; which now we must consider in so far as they have any Relation to this above described Motion of the Crystalline. This Author maintains that it is impossible the Crystalline can change its Situation, because the *ciliary Ligament* is not muscular, and consequently has no Power of Contraction : and of this Opinion are likewise a great many Anatomists, and in particular *Hovius* ; but it appears that all of them have been led into this Mistake, by an unjust Notion they have entertained about the Colour of Muscles. Every body knows that our Muscles are generally of a red Colour, but it does not from thence follow that what is not red is not muscular ; the muscular Fibres of the Guts and Stomach have scarce any thing of Redness in their Colour, and it is also certain that the Pupil does contract and dilate itself according as Objects are more or less luminous, and yet none of the Fibres which perform that Action are in the least red ; whence it follows, that the Fibres of the *Ligamentum ciliare* are not to be deprived of a Power of Contraction, because of a Colour different from what generally obtains in other Muscles ; nor are we to be surprized that so many accurate Anatomists, after a careful Examination of this Process, have not scrupled to affirm it to be truly muscular.

On what has been said, I shall now make a few obvious Reflexions by way of Corollary. And

1st, Seeing that the natural State of the *Ligamentum*

gamentum ciliare, like that of all other Muscles, is a State of Relaxation, it is easy to see that the Crystalline must then be as near to the *Retina* as possible; whence it follows, that the Eye is naturally dispos'd to see distinctly only distant Objects, and that that Disposition whereby it is fitted for the distinct Vision of near Objects, arising from the Contraction of this *Ligament*, is a State of Violence introduced at the Command of our Will: For Confirmation of which we might appeal to every one's Experience, who we doubt not will acknowledge, that when they are sitting carelessly, without attending to any Object, nothing at an ordinary Distance appears distinct, till a certain Effort be exerted, which will be remarkably greater in Proportion as the visible Object is nearer; and this also agrees perfectly well with that necessary Connexion and Dependence that Habit and Custom has established betwixt the Motions of the *Crystalline* and certain corresponding Motions in the *Axes of Vision*, which makes it impossible for us to direct our Eyes to any Object, without at the same time giving them that Disposition that is necessary for seeing distinctly at that Distance; for as our Eyes are naturally adapted for seeing distinctly only distant Objects; and as that Disposition, whereby they are fitted to near Objects, is a State of Violence that requires an Effort greater or smaller, as the Object is nearer or further off; so the Axes of our Eyes are naturally parallel, which is the Direction proper for distant Objects; and when they are directed to a near Object, an Effort must be exerted, which also will be greater or

smaller;

smaller, in Proportion as the Object is nearer or further off; which Harmony and Agreement of Motions I esteem a very great Confirmation of this Doctrine.

2dly, From what has been said we may clearly see, whence it is that our Eyes are so soon fatigued in looking to near Objects, which seldom happens when the Object is at any considerable Distance; for when the Object is near, an Effort must be exerted, both by the Muscles of our Eyes, for giving them the necessary Direction, and by the *Ligamentum ciliare*, for giving them the necessary Conformation; which Effort being always greater in Proportion as the Object is nearer, must be painful and laborious when the Object is very nigh; whence arises that Fatigue so often felt, in looking long at near Objects; but when the Object is at any considerable Distance, so great an Effort is not required, especially by the *Ligamentum ciliare*, which, by some Experiments taken notice of above, is in my Eyes totally relaxed at the Distance of twenty seven Inches, whence at that and all greater Distances, no Uneasiness can be felt, unless the Object be too bright and luminous, but what arises from the Direction of my Eyes, which is very inconsiderable; and therefore my Eyes are not soon fatigued in looking at an Object, whose Distance is greater than twenty seven Inches; but when the Distance is less, they soon become sensible of an Uneasiness, which being proportionally greater, as the Object is nearer, does soon require that the Eyes be relaxed; and this is the true Reason, why none

none of us are able to look long to a very nigh Object.

3dly, From this also it is easy to understand, whence it comes to pass, that after the Eye has been very attentive, in considering an Object at a certain determined Distance, it cannot presently see another Object distinctly, at a greater or less Distance, though both Objects seem to touch one another, being nearly in the same Line : For since the Conformation of the Eye must be fitted to the Distance, some time will be required for finding out by repeated Trials, that precise Disposition which is necessary for seeing the Object at that Distance ; and therefore it must appear confused and imperfect, till the Eye has exactly adapted itself to the Distance of the Object.

4thly, This Motion of the *Crystalline*, whereby our Eyes are accommodated to the Distance of Objects, being intirely voluntary and subject-ed to our Mind, which, being a wise Agent, wills its Motion that Objects may not appear confused, it follows, that when by any other Means this Confusion is taken off, the Mind will not then change the Conformation of our Eyes, unless there be something else, that can influence it to such an Action ; and this, after many Conjectures upon the Matter, I take to be the true Reason why the Eye is not adapted to the Distance of Objects, viewed through a small Hole made in a Card ; and why, when viewed through several small Holes, whose Distance from each other does not exceed the Diameter of the Pupil, they appear multiplied according

to

to the Number of Holes, as has been observed above.

5thly, Though this Motion of the Crystal-line be subjected to our Mind, which, when the Object appears confused, changes its Situation, till by repeated Trials it finds out the precise Place it ought to possess, for rendering our Sight as distinct as possible ; and tho' this Confusion in our Sight seems to be the only thing that should influence our Mind to such an Action ; yet by reason of a habitual or customary Connexion that has grown up between the Motions of the *Crystalline* and corresponding Motions of the *Axes of Vision*, these Motions come at last always to accompany one another, and that so necessarily as to make it impossible for us to separate them by any Act of Volition : Thus, when we view any Object at two Foot Distance, we not only accommodate our Eyes to that Distance, but we also move our Eyes, so as their Axes produced may meet in some Point of the Object ; whence it comes to pass, that these Motions, which at first had no necessary Connexion or Dependence on each other, do in Time come to cohere so closely, as to make it impossible for us to direct our Eyes to an Object at two Foot Distance, without at the same Time giving them that Disposition that is necessary for seeing distinctly at that Distance ; and what has been said of Objects at two Foot Distance, is also true of Objects at all other Distances within the Limits of distinct Vision ! Whence it is easy to see, how our Eye may be made to change its Conformation, when an Object is viewed through a small Hole

Hole made in a Card, tho' by Reason of the Smallness of the Hole, the Object appears always distinct, even when the Eye is not adapted to its Distance ; for seeing the Motion of the Crystalline is, by Custom and Habit, made to follow a corresponding Motion in the *Axes* of our Eyes, it follows, that by changing the Direction of our Eyes, the Eye must also, at the same time, accommodate itself to the Distance at which the *optick Axes* meet. It is for this Reason, that when a small Body appears single, when viewed through two small Holes, whose Distance does not exceed the Diaméter of the Pupil, it may be made to appear double, and if its Distance be such, as makes it appear double, the Distance betwixt the Appearances may be increased or diminished, and all this only by changing the Direction of our Eyes.

6thly, This Motion of the Crystalline, by which our Eyes are adapted to the Distance of Objects, has its Limits beyond which it cannot go ; whence it is, that none of us can see distinctly with the naked Eye, but within certain Limits, beyond which, if the Object be placed, it must appear confused more or less, as it is further removed from the Limits of distinct Vision. These Limits are at different Distances, according to the Difference of Peoples Eyes ; and very often in the same Man, both Eyes have not the same Limits, which is oftentimes of the same Use, as if the Limits of both Eyes were more distant from one another ; for one may see an Object distinctly enough with only one Eye ; but if the nearest Limit of one Eye is further off than the furthest

thest of the other, then near Objects and distant Objects may be seen distinctly, but the intermediate ones must appear confused, which is a Case that is very apt to surprise such as despise or neglect Theory.

7thly, The *Ligamentum ciliare* being the only Instrument by which our Eyes can be fitted for seeing distinctly at different Distances, it follows, that whatsoever affects the Oeconomy and Action of this Ligament, must also affect our Sight. Thus, *imo*, When it has become paralytick, no near Object will appear distinct; for an Example of which, see *Foresti observationes*, Lib. XI. Observ. XXXVI. His Words are, *Generosus vir & Dominus de Ben-thuysen, anno 1567, mense Majo, cum ad eum accitus essem, conquerebatur se proprius admota hebetius videre, longinqua vero optimè, &c.— Quibus præsidiis tandem hoc vitium cessavit, &c.* Nor are we to imagine that the Case here was only a common *Visus senilis*: For who is it that calls a Physician on such an Occasion? And as this Disease never yields to Medicine, it would not have been said, *Quibus præsidiis tandem hoc vitium cessavit.*

2d^o, If this Ligament should be convulsed, no distant Object will appear distinct. We have a beautiful Case to this Purpose recorded by *Timæus*, which I shall also set down in the Author's own Words: *Studioſus quidem juvēnis* (says he) *queritur se mensæ affidentem legere posse etiam minutis literulis consignata, non tamen internoscere si qui hominum conclave ingreduntur, donec proximiūs accendant, longius vero diffita planè se non cernere: duravit iste affetus*

Etus jam ferè sesquiennio. Timæi Cas. medicinal. Lib. I. Cas. XXV. The Author indeed resolves this Case into a Thickness and Muddiness of the Humours of the Eye; but to me it seems more reasonable it should have been resolved into a Contraction or Spasm of the *Ciliary Process*, and if, by means of a concave Glass of a due Degree of Concavity, distant Objects could have been distinctly seen, (of which the Author has taken no Notice) this would have served as a Proof of our Conjecture: For on *Timæus's* Supposition, as also on the Supposition, that this Symptom proceeded from a certain Degree of Insensibility in the *Retina*, or immediate Organ of Sight, such a Glass would have rendred the Sight yet more dark and confused than before.

From this we may possibly see why in hysterick and nervous Cases, a certain Dimness of Sight is so frequently complained of; and in particular, why *Piso's* Matron was seized therewith for an Hour before her hysterick and convulsive Paroxysm, (*Piso de Colluv. serof. Obs. XXV. p. m. 146.*) For though this Symptom may arise from a Numness or certain Degree of Paralysis, and Insensibility in the optick Nerve, yet as certain it is, that it may also proceed from a Spasm in this muscular Process; and seeing both are equally possible, I see no Reason for admitting the one and rejecting the other, without a very exact and impartial Examination of all the Phænomena, which in such Cases are commonly overlook'd. The great *Hippocrates*, in many Parts of his Writings, has observed this Dimness of Sight to be the Attendant, as well as the Harbinger of Spasms.

and convulsive Motions ; whence it seems reasonable to suppose, that in many such Cases it should also itself be occasioned by a Spasm in this Process, whereby the Eye is disqualified for seeing distinctly at an ordinary Distance. But all this I propose only by way of Conjecture, leaving it to be further examined by others, as Occasion shall offer. In the Case of some Poisons, the Matter seems somewhat plainer ; for as *Nicander*, *Dioscorides*, and others have long ago observed, that this Dimness and Obscurity of Sight, together with Spasms and Convulsions of various Kinds, are the common Consequences of *Hemlock* taken internally, so it seems pretty evident from a Passage in *Ægineta*, that this does not proceed from any Degree of Insensibility in the Organ of Vision, but from a Spasm in this Process. See *Lib. V. Cap. XLI.* where, speaking of this Subject, the following Words are very remarkable : " The Sight becomes so dim, that a Man is wholly deprived of the Sight of distant Objects." But I must go on.

3to, If this muscular Process should be paralytick in one Side, and sound in the other, the Crystalline must get an oblique Situation, when we look at near Objects, whence they will not appear distinct, unless the Eye be turned aside from the Object. And,

4to, If this same Process is convulsed on the one Side, while the other Side is healthful, the Crystalline will also get an oblique Situation, but not unless we view distant Objects, in which Case also it will be necessary to turn our Eye away from the Object it would view, that its Picture may

may fall on the *Retina* towards the *Axis* of the Eye, where it is most sensible. But,

5to, If in the one Side it should be convulsed, whilst it is paralytick in the opposite Side, the Crystalline will always have an oblique Position, at whatever Distance the Object may be placed ; and therefore the *Strabismus* arising from this Cause, must be constant and uninterrupted : whereas, in the two former Cases, it only takes place in certain Circumstances. But for the better understanding what has been said, on this and the two immediately preceding Heads, it may be proper to review what I have said on the Subject of the *Strabismus* in the former Part of this Essay ; from which it will also appear, that in all these Obliquities of the Crystalline, the Object will not be seen in its proper Place, where it is seen with the other Eye, but will be thence translated to some other Place, from which Translation it must necessarily appear double.

6to, When this Ligament has become rigid and stiff, the Crystalline will have but very little Motion, whence the Limits of distinct Vision will be very narrow : Thus it is with all those who are much employed in any subtile Work, such as Engravers, Jewellers, Watchmakers, Painters in Miniature, &c. who are very apt to become short-sighted from their constant Application to small Objects, which cannot be distinctly seen but at a very small Distance, and therefore they are obliged, by the Contraction of this *Ligament*, to bring the Crystalline as near to the *Uvea* as possible ; but all Muscles that continue long in the same State become ri-

gid and stiff, and lose much of their Activity : : And therefore, this *Ligament*, by its constant Contraction, must at last shrink, and have its Fibres shortened, which will keep the Crystal-line fixed in that Situation, by which the Eye is disqualified for seeing distant Objects distinctly. This has been observed by *Ramazzini, de morbis artificum Cap. XXVI.* who therefore judiciously advises all such, from time to time to intermit their Work, and recreate their Eyes with a Diversity of Objects, lest they should lose their Mobility and become short-sighted. The Reverse of this Disease happens to such as are seldom employed in observing near Objects, but who from their Infancy have accustomed themselves to look much to distant Objects, such as Hunters, Falconers, Sailors, &c. In those this Ligament is much relaxed, by which they can see at a great Distance; but by reason they are so little accustomed to observe near Objects, it loses much of its Faculty of Contraction, whence they cannot accommodate their Eyes to near Objects: And thus we see how the *Visus senilis*, as well as the *Myopia*, may be acquired by Use and Custom. But I must go on.

8thly, The eighth and last Reflexion I shall make on this Subject, shall respect the Cause of this Change of Conformation in our Eyes, which is either *efficient* or *final*.

As to the *efficient Cause*, it has been already demonstrated, that this lies in the *Ligamentum ciliare*, which being muscular, does by its Contraction change the Situation of the *Crystalline*, according as Objects are nearer or further off. But lest it should be imagined, that our Mind does

does not preside over this Motion of the *Cry-stalline*, by reason we are so very little conscious of its Influence, it must here be observed, that there are many other Motions that are no doubt voluntary and depending on our Mind, of which we are every bit as little conscious. No body denies but the Mind presides over those Muscles which tune the Ear, and yet we are not conscious of their acting. The Motions of the Eye-lids are also all voluntary, though we are often insensible of them, and even in many Cases cannot, by any Act of Volition, hinder them to move in a particular Manner: Thus, when the Eyes are turn'd up or down, the Eye-lids always follow their Motion, and keep at the same Distance from the Pupil; and if a Body be hastily moved towards our Eyes, they will shut without our being conscious thereof: Neither is it in our Power to do otherwise, because we have accustomed ourselves to do so on the like Occasions; for such is the Power of Custom and Habit, that many Actions which are no doubt voluntary, and proceed from our Mind, are in certain Circumstances rendred so necessary, as to appear altogether mechanical and independent on our Wills; but it does not from thence follow, that our Mind is not concerned in such Motions, but only that it has imposed upon itself a Law, whereby it regulates and governs them to the greatest Advantage. In all this there is nothing of intrin-sical Necessity; the Mind is at absolute Liberty to act as it pleases; but, being a wise Agent, it can-not choose but to act in Conformity to this Law, by reason of the Utility and Advantage that arises

from this Way of acting : Thus the Ear is tuned to different Sounds, the Eye is accommodated to Objects at different Distances, the Pupil is proportioned to the Intensity and Weakness of Light, while at the same Time we are not conscious of our having done any Thing : and when these and such like Motions have become necessary in certain Circumstances, so as to render any other Motion impossible, this does not make them mechanical and independent on our Will, but only shews us, that the Mind, which at first always acted from a Principle of Interest, comes at length to be determined by Habit and Custom, without examining how far such Motions may be profitable or hurtful to us, or at least without being sensible of any such Examination : And this is the only Reason can be given why none of us are now able to move our Eyes differently, though when Children we were possessed of that Power, and with respect to the Eye-lids, the Case is exactly the same ; for though we are not now at Liberty to keep them open when any thing is hastily moved towards our Eyes, yet that this proceeds intirely from Custom, and not from any absolute or mechanical Necessity in the Thing itself, is evident from this single Consideration, that some may be found who can keep them open, though the Organs subservient to their Motions are the same as in other Men. Thus it was with the two *Roman Gladiators* taken notice of by *Plempius* (*Ophthalmogr. Lib. I. Cap. II.*) who being of uncommon Fortitude and Courage, had not accustomed themselves on every trifling Occasion to shut their Eye-lids for the

Defence

Defence of their Eyes, whence their Motions continued arbitrary in the strictest Sense. Thus also it seems to have been with that excellent Philosopher *Socrates*, who in the Judgment of *Apollo* was the wisest Man on Earth ; and yet, for no better Reason than that, to accustom himself to Patience, he was wont to stand for a whole Day like a Statue, without the least Motion, not so much as of his Eyes or Eyelids, (*Gell. Noct. Att. Lib. II. Cap. I.*)

But the Matter does not stop here ; our Mind does not only preside over the Motion of the *Crystalline*, and such other Motions as are commonly said to be voluntary, but there is good Reason to suspect, that it extends its Dominion and Influence even over all the *vital* and *natural Motions*.

Some very great Philosophers, and particularly *Des Cartes* and his Followers, have been of Opinion, that our Mind always thinks, and yet this is what we are often very little conscious of ; and if the Mind can think without our Knowledge, I see not why it may not also be allowed to exert its active Power in the Government of the *vital* and *natural Motions*, without our Knowledge or Attention.

I know it has been alledged by *Locke* and others, That all the Thoughts and Operations of the Mind must necessarily be attended with Consciousness ; from whence it may be argued, that the Mind is not concerned with these Motions, because it is altogether insensible of its Influence. But without determining how far the Thoughts and Operations of the Mind may or may not imply Consciousness, which is a

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metaphysical Question, I leave to be disputed by those who have better thought of that Matter; it is sufficient for my present Purpose to have shewn in a few of many Instances that might have been brought, that there are Motions unquestionably voluntary and depending on the Mind, which by Custom and Habit have become so easy as to be performed without our Knowledge or Attention, and that so necessarily as to make it impossible for us, by any Effort of Mind, to hinder them from going on in their usual Manner. And seeing every one's Experience and Observation may afford him many Instances of such Motions as these, I would gladly know why the *vital* and *natural* Motions should be esteemed of a different Kind.

That they cannot be accounted for from Mechanism alone, is very certain; for all the Hypotheses that have hitherto been, or may hereafter be invented, for explaining those Motions mechanically, do and must proceed upon the Supposition of the Possibility of a perpetual Motion. By a perpetual Motion, I mean an uninterrupted Communication of the same Degree of Motion, from one Part of Matter to another, in a Circle, so as perpetually to return undiminish'd upon the first Mover, which, in the present Constitution of Things, is repugnant to the Laws of Nature; for seeing *all Motions and Changes made in the Motions of Bodies are always proportional to the impress'd moving Force*; and seeing all Motions on this Globe are performed in a resisting Fluid, *viz.* the Air, a considerable Quantity of the Moti-

on must be spent in the Communication on this *Medium*; and consequently it is impossible the same Quantity of Motion should return undiminish'd upon the first Mover, which is necessary towards a perpetual Motion. Moreover, the Nature of all material Organs is such, that there is no avoiding a greater or lesser Degree of Friction, though the Machine be form'd according to the exactest Principles of Geometry and Mechanicks, there being no perfect Congruity, nor exact Smoothness in Nature: And this also must very considerably diminish the communicated Force; so that on both these Accounts it is impossible there should be a perpetual Motion, unless the communicated Force were so much greater than the generating Force, as to recompense the Diminution made herein by these Causes; so that the impress'd Motion may return undiminished to the first Mover: But that being contrary to the above mentioned Law of Motion, it is clear that the Motion must continually decrease, till it at last stop, and consequently there can be no perpetual Motion in the present State of Things: *Liquet ex calculo mathematico*, says the learned Dr. Clarke, (in *Rohault, phys. § 1. cap. 22.*) *omnem de motu perpetuo quæstionem è redire, ut pondus inveniatur seipso ponderosius, vel vis elastica seipsa fortior, quod est absurdum.*

No body, now-a-days, that understands any thing of Nature and Philosophy, can so much as imagine that any Animal, how abject soever, can be produced by Mechanism, without any active immaterial Cause; we all know there is nothing in the animal Machine but an Infinity
of

of branching and winding Canals, filled with Liquors of different Natures, going the same perpetual Round, which are no more capable of producing the wonderful Fabrick of another Animal, than a Thing is of making itself. Besides, in the Generation of an Animal, there is a Necessity that the Head, Heart, Nerves, Veins and Arteries, should be formed at the same time; which can never be done by the Motion of any Fluid, what Way soever moved: For the Heart cannot move, unless animal Spirits be sent from the Head through the Nerves into it. The animal Spirits cannot be derived into the Heart, unless the Blood be squeez'd by the Heart through the Arteries into the Brain; so that it is evident that the Head and Heart, the Arteries, Veins and Nerves, must all be formed at the same Time, and not successively, if the Animal is mechanically produced. But this is altogether impossible; for no Motion of any Fluid or Fluids, howsoever disposed, can form all these at the same Instant; and we know all the internal mechanical Actions of Animals are performed by the Force of their circulating Fluids. From these and such like Considerations, it is evident, that an Animal cannot be produced mechanically. This is too hard a Problem to be solved from so few *Data* as Matter and Motion, and it is doing Penance to read the wretched Accounts of the wisest and most learned Physicians and Philosophers on this Head: Read but *Des Cartes*, who by a bold, not to say impious Attempt, was the first since *Prometheus* and *Democritus*'s Days, who endeavoured to make an Animal; I say, read but

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Des Cartes, and you'll see how in every Step he contradicts the known Laws of Motion: And indeed the Manner after which he will have them generated, is as much above the Power and beyond the Laws of Mechanism, as the true and genuine Manner and Method of their Production is. Seeing then that the Formation of Animals does not depend on Mechanism, but on the powerful Influence and Operation of some immaterial Cause, whether of God himself, the Soul of the Animal, or of some other subordinate Being, some vital Principle, plastick Power, or *Archæus*, concerns not the present Question: I say, seeing that Animals are not at first produced by Mechanism, but by some active immaterial Cause, why, after that, so great Concern should be shewn to reduce all to mere Mechanism, and to exclude an intelligent and active Principle from having any Share in the Government of those Motions on which Life depends; and why it should be thought that these Motions should never stand in need of new Impressions from some such vital Principle as first set them a-going, I cannot so easily conceive.

If it should be said, that these Motions do not depend on Mechanism alone; but on Mechanism joined with certain active Powers or Forces, imprinted by the Author of Nature upon all the Bodies of this Universe, such as are the Powers of Attraction and Repulsion, by which indeed the greatest Part of the Phænomena of Nature are unquestionably produced; it is incumbent on those who entertain this Opinion, to explain particularly how these Motions

ons are thus continued by these active Principles, before they can expect we should believe them. Could one single Instance be brought of any Motion that goes on perpetually in this Manner, without standing in need of new Impressions from any active and intelligent Cause, there might be some more Pretence for this Hypothesis; but as no such Instance is to be found, I see no Necessity of having Recourse to such a Supposition, for explaining the vital and natural Motions.

Is it not certain that these Motions are powerfully influenced by the Passions of Fear, Grief, Joy, Rage, &c.? And does not this clearly shew their Dependence on the Mind? The learned Dr. Cheyne (on the *English Malady*, p. 307.) gives the Case of Colonel Townshend, who for some Time before his Death could at Pleasure suppress all the vital Motions, so as in all Respects to appear dead, and yet by an Effort, or some how, he could come to Life again, and restore these Motions. The Case is indeed singular, but not at all to be accounted for, without allowing the Mind to preside over the vital Motions. But this is not all; for in some Creatures the Motion of the Heart has been found so irregular, as to give Cause for esteeming it altogether arbitrary in the common Acceptation of the Word. There is a remarkable Instance of this recorded by Lister, which I shall set down in the Author's own Words. *Denique* (says he, speaking of the *Cochlea*) *cor-
nudatum, & oculis, ut hac sectione fit, planè
objectum, modo sponte ad aliquam multa mo-
menta, imo quadrantem horæ, pulsare desiit;*
iterumque

iterumque sponte se strenue, & celeriter movebat. Ut certissimum sit, cordis motum, in id genus animalibus, etiam voluntarium esse, & non merè naturalem, ut in homine reliquisque sanguineis animalibus; sed pro earum lubitu ad quodvis tempus sisti, aut moveri posse, &c. See Lister de cochleis & limacibus, p. 38.

All these Things being considered, it seems probable to me that the Mind does not only preside over those Motions commonly called voluntary, but that it is also constantly employed in the Government of all the *vital* and *natural* Motions, which of themselves would soon stop, were it not for the Influence and Interposition of this active Principle. It seems to me further, that these Motions in the Beginning of Life are altogether arbitrary, in the common Acceptation of the Word, and that it is only from Use and Custom that they have become so necessary as to make it impossible for us, by any Effort of Mind, to hinder them from going on in their usual Manner. The above mentioned Case of Colonel Townshend seems inexplicable on any other Hypothesis; but when this is once granted, it admits of a most easy Solution, it being no more difficult to conceive how by repeated Endeavours we should get the better of that Necessity, whereby the Heart moves, according to the Laws the Mind has originally imposed on itself, than it is to conceive how the Mind can get the better of that Necessity, whereby our Eyes are mov'd uniformly. It is indeed no easy Matter to squint, after that the uniform Motions of our Eyes have once been established by Habit and Cu-

stom, yet we are taught by Experience, that the Thing is not altogether impossible; and seeing the Necessity whereby the *vital Motions* go on in a constant uniform Manner is of the same Kind with that Necessity whereby our Eyes continue their uniform Motion; if the Mind can get the better of the one, I see no Reason why it may not also sometimes get the better of the other, and for a Time suppress all those Motions on which Life depends: Nor is it more surprizing that none of us are now able, by any Act of Volition, to retard, accelerate, or put a Stop to the vital Motions, than it is that we cannot now give our Eyes different Motions, nor move our Eyes up or down, without at the same time moving our Eye-lids.

It is a common Observation, that the *Fœtus* in the Mother's Womb passes almost its whole Time in an unactive sleepy State; and even Infants newly come into the World are seldom awake but when either Hunger calls for the Teat, or some Pain (the most importunate of all Sensations) or some other violent Impression on the Body, forces the Mind to perceive and attend to it: And if we follow a Child from its Birth, and observe the Alterations that Time makes, we shall find that it comes to be more and more awake, thinks more and more of external Objects, and at last begins to know the Objects, which, being most familiar with it, have made lasting Impressions. If all this be duly considered, perhaps some Reason may be found for imagining, that in the Beginning of Life the Soul is wholly taken up in regulating and governing the internal Motions, which

are yet difficult, by reason it has not been much accustomed to them ; and therefore do require a close and constant Application of Mind, which draws off its Attention from Things external, whence the Child must appear to be in an unactive sleepy State : But as these Motions grow easier, the Mind by Degrees attends more and more to external Objects, seems less and less sleepy and unactive, till by Use and Custom these Motions do in Time become so easy as to be performed without our Knowledge or Attention, and that so necessarily as to make it impossible for us, by any Act of the Mind, to hinder them from going on in their usual Manner ; and then the Mind being at full Liberty to employ all its Thoughts about other Matters, the Creature appears no longer sleepy and unactive.

It were easy to illustrate and confirm this Doctrine by many familiar Examples ; observe but Children when they first begin to walk, and you'll find that the whole Mind is employed in conducting the Motions necessary for their Progression, insomuch that if any thing shall divide the Mind, and draw off its Attention, they presently tumble down, by reason of the Difficulty that attends the Government of these Motions, which cannot be rightly conducted, while the Mind gives Attention to any thing else ; but when Use and Custom have once made these Motions easy and familiar, then they need but little Attention, and allow the Mind to employ its most serious and anxious Thoughts about other Matters. And what has been said of walking, is in some Measure also true of

speaking, singing, playing on musical Instruments, and many other Exercises, whose Difficulty is only overcome by Habit and Custom. Seeing then that there are many Actions that in the Beginning require so entire and undivided an Application of Mind, which nevertheless do in Time become so easy as to need but little Attention, I see not why it may not now, after all that has been said on this Subject, be allowed that the Soul in the Beginning of Life is wholly taken up in the Government of the internal Motions, which by Use and Custom do in Time become so easy as to be performed without our Knowledge or Attention, and that so necessarily as to make it impossible for us to hinder them from going on in their usual Manner. But I am wearied of this Subject, upon which I should not have dwelt so long, had it not been that I understood that some were greatly surprized that I should have supposed in the former Part of this Essay, (*Med. Eff. Vol. III. p. 258.*) that *the Mind may possibly preside over the vital and natural as well as the animal Motions*: To take off which Surprize, and to show that the Thing is at least possible, I have been obliged to enlarge beyond what I intended. Let us now proceed to the *final Causes* of this Change of Conformation in our Eyes.

It has already been shewn in general, that had the Eyes continued unvariably the same, there could have been no distinct Vision, but one determined Distance, either great, middle or small, according to the particular Disposition of Peoples Eyes: But that the several Phænomena, arising from this Defect in our Eyes,

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and the Benefits we receive from the Change that happens in their Conformation may be the better understood, it may not be improper that I should here briefly explain the Phænomena that attend short and long Sight, to which the Case before us is altogether similar and analogous; this only excepted, that in the *Myopia* and *Visus senilis* there is always some Latitude of Sight; whereas did not the Crystalline change its Situation, distinct Vision would be confined to one determined Distance, and with respect to Objects at a greater or lesser Distance, the Eye would be myopical or presbytical.

By *Myopes*, or People that are short-sighted, I do not mean such as have a small *Pupil* or *turbid Humours*, who on that Account are also short-sighted, by reason that a sufficient Quantity of Rays do not pass to the *Retina*, unless when the Object is near; nor do I mean such as have a Weakness of Sight, proceeding from a certain Degree of Callosity, Paralysis, or Insensibility in the *Retina*, by which the Vision is very faint and obscure, unless when the Object is very bright and luminous, or when, because of its Proximity to the Eye, it sends a greater Number of Rays to the *Retina*: But by *Myopes* I understand, such as have the *Cornea* and *Crystalline*, or either of them too convex, or that have the Distance betwixt the *Retina* and *Crystalline* too great. From this Disposition of the Eye it is plain, that

imo, The distinct Picture of Objects at an ordinary Distance will fall before the *Retina*, and therefore the Picture must be confused on the *Retina* itself; from which Confusion in the

Picture, the Vision will also be confused and indistinct. Whence,

2do, In order to see distinctly, they are obliged to bring the Object very nigh to their Eyes; by which means the Rays that are now more diverging are made to converge and meet at the *Retina*, where a distinct Picture will be made, from which the Object will be distinctly seen.

3to, They that are short-sighted never look attentively to those that speak to them; for by reason of this Defect in their Sight, they cannot exactly observe the Motion of the Eyes of those that speak, which contributes greatly to explain their Thoughts, and augment the Force of their Words; and therefore they are only attentive to their Discourse, without fixing their Eyes on any Object. *Pliny* calls those who have big and prominent Eyes *Hebetiores*; but it is not to be supposed that this Bigness in their Eyes can any way impare their Genius, or lessen their Vivacity: But as those who have such Eyes are commonly short-sighted, they do not look attentively to those that speak to them; whence they may be thought to be more dull and stupid than others, for we commonly judge of Peoples Attention from the Disposition of their Eyes.

4to, Short-sighted Persons need less Light for seeing clearly than others, and can easily read the smallest Print at the Light of the Moon, or in the Twilight, when such as have good Eyes are not able to distinguish one Letter from another: The Reason of this is plain; for when the Object is near, more Light enters the

the Pupil, and acts more powerfully upon the *Retina* than when it is at a greater Distance; but they who are short-sighted must, in order to see distinctly, bring the Object near to their Eyes: Whence the Impressions made on the *Retina* by the Rays of Light, and the Vision that is caused thereby will be stronger than in those who cannot see distinctly but at a greater Distance. But besides this, in the *Myopia* the Pupil is very large, on which account also more Light will enter the Eye, for rendering the Sight clear. That the Pupil is large in myopical Eyes, is a common Observation; nor will the Reason thereof be difficult to any one who shall consider that, *1st*, The natural State of the Pupil is a State of Dilatation, as is manifest from its being very large in Faintings, and upon first waking, as also after Death. *2dly*, The Cause of the Contraction of the Pupil lies in the Mind, which wills the Contraction of its orbicular Fibres, either when the Light is too strong, or when the Picture is not distinct upon the *Retina*. *3dly*, When the Sight is perfect, that is, when it is neither too strong or too weak; and more especially when the Sight is weak, as in old Men, all Objects that are very near the Eyes will appear confused; on which Account, as well as on Account of the Quantity of Light that enters the Eye, the Pupil will be contracted: Whereas in short-sighted People, near Objects appear distinct, and therefore the Pupil does only contract, by reason of the too great Quantity of Light that enters the Eye, which also they can easily avoid, by retiring into a darker Place, as every body commonly

commonly does, when the Light is too strong: And this is one Reason why the Pupil, which in Children is very large, does always continue so in those who are short-sighted, and who are not obliged to contract it for seeing more distinctly. But in the *Visus perfectus*, and especially in the *Visus senilis*, the Pupil must become smaller and smaller by Degrees; for by reason of its frequent Contraction for seeing near Objects more distinctly, the orbicular Fibres shrink, and become shorter; by which means the Pupil becomes narrower, just as the Fingers of Work-people are much bended from the frequent Contractions of the *flexores digitorum*.

5to, *Myopes* have their Sight mended by a concave Lens of a due Degree of Concavity; for the Refraction being here too strong, in proportion to the Distance of the *Retina* from the Crystalline, this Refraction will be diminished by the Interposition of such a Glass, and the distinct Image of the Object will be made to fall upon the *Retina*: But as such Glasses represent Objects under a less Angle, they must appear less than to the naked Eye; which is what surpriseth the most such as are short-sighted, and who for want of Knowledge in Opticks are prepossessed with the Opinion, that Objects are always best seen when they appear largest.

6to, Their Sight will also be mended, by looking through a small Hole, such as that made by a Pin in a Card; for the little luminous Pencils, which have for their Apex a Point in the Object, and for their Basis the little Hole,

Hole, will, by reason of their Acuteness proceeding from the Smallness of the Hole, take up so small a Space on the *Retina* as to occasion but little Confusion in the Picture; whereas, without the Interposition of the perforated Card, the luminous Pencils will have a Base as large as the Pupil itself, and consequently must occupy a much larger Space upon the *Retina*, from which the Picture, and the Vision thereby occasioned, will be a great deal more confused than when the Object is viewed thro' the small Hole. And this is the Reason why short-sighted People, to see distant Objects more distinctly, call to Assistance their Eye-lids, which they shut so as to leave open only a very small Slit, by which the Confusion in the Picture is in some measure corrected, and the Sight is made more distinct, tho' less clear.

7mo, Short-sighted Persons commonly become less so, as they advance in Years, and that because the Humours of the Eye do daily waste and decay; from which Decay in the Humours, the *Cornea* shrinks, and becomes less convex, and the Crystalline becomes flatter than before, by which means the Rays of Light will be less refracted, and will not meet so soon behind the Crystalline; and therefore the Image on the *Retina*, and the Vision caused thereby, will be more perfect and distinct, and the Eye will be enabled to see at a greater Distance, than when the Refraction was stronger in the more plump and convex Eyes: Whence we may see, why very young Children never take notice of any Thing but what is close upon their Eyes; for in them the *Cornea* is too convex

convex and prominent, to allow them to see distinctly, or attend to Objects at an ordinary Distance. This has been taken notice of by *Des Cartes*; and skilful Painters seem to be well acquainted with it, who therefore, when they paint young Children in Profile, give the *Cornea* an uncommon Convexity.

8vo, Small lucid Bodies, when at a considerable Distance, appear great, round, and frequently full of Spots. For understanding this, let H (Fig. 10.) be the Eye, and let the Candle A be the Object, which is here supposed to be at the Distance of about sixty Feet, and which by reason of its Distance may be conceived as a Point. The Rays of Light AB, AC, &c. will, after Refraction in this *Myopical Eye*, converge and meet in a Point before the *Retina* as at o, and after that they will diverge and form on the *Retina* the large Image de, which will have the same Figure with the Pupil, and consequently will be round. From the extreme Points of this Image d and e, draw through the Center of the Eye L, the right Lines dLD, eLE: These Lines will be perpendicular to the *Retina*, at the Points d and e; and consequently the Object A will, by means of its luxuriant Picture on the *Retina* de, be seen under the Angle DLE. If therefore about the Center A, with the Radius AD or AE, the Circle ADE be described, the small Object A will be seen uniformly extended over all that Circle, and consequently must appear big and round.

Whence they that are skilled in Opticks will easily see that, 1st, When the small Object A is at a very great Distance, the Appearance will also

also be very great. At sixty Feet Distance, a Candle commonly appears a luminous Circle of about a Foot Diameter; but this will be greater or smaller, according to the Degree of Shortness of Sight, and Magnitude of the Pupil.

2dly, The nearer the Object is, the Appearance will be the less, and will approach the nearer to the natural Figure of the Object.

3dly, When two or more Candles of unequal Magnitude are seen at a great Distance, they will appear equal, and if they are not far from one another, their circular Appearances will cut each other; thus a Lustre full of Candles puts on the Appearance of a Globe of Fire.

4thly, If the Hand be gently brought before the Eye, before that any one of these circular Appearances are hid, some Part of each Circle will be made to disappear; and this Part that is made to disappear will lie on the same Side with the interposed Hand; whereas in the *Visus senilis* it lies on the opposite Side, as will be shewn below.

5thly, From this also it is easy to understand, why to all of us the Stars appear larger than they ought; for the Eye with respect to them being purblind, they are seen under a greater Angle, and consequently must appear greater, for the same Reason that a distant Candle appears so to a *Myops*: Whence it is, that when the fixed Stars are viewed through a small Hole made in a Card, they seem much less than when seen with the naked Eye; for the Luxuriancy of the Image being in some measure corrected by the Smallness of the Hole in the Card, the Stars themselves

themselves must necessarily appear smaller: And this also is one Reason why the Telescope, which increases the Magnitude of all other Objects, diminishes that of the Stars; for this optical Instrument does not here magnify so much by increasing the Angle under which they are seen, as it diminishes by uniting the Rays at the *Retina*, and by that means correcting the Luxuriancy of the Picture: Nor is it any solid Objection to this, That the Sun and Moon, with respect to the Distance of both which, no doubt the Eye is also myopical, do appear larger when seen with a Telescope than with the naked Eye; for it must be observed, that at a given Distance, the Luxuriancy in the Image, proceeding from the Rays not being accurately united at the *Retina*, is always the same, and is not augmented according to the Magnitude of the Object; and therefore, in large Bodies, such as the Sun and Moon, it bears but a very small Proportion to the true Magnitude of the Image, and consequently, when this Luxuriancy is cut off by the Telescope, it makes no sensible Detraction from the Magnitude that arises from the Augmentation of the visual Angle. And of the same Kind with this Appearance of the Stars, is also the Appearance of a distant Candle, which in the Night-time seems larger than it ought to most Eyes; because the Eye, with respect to its Distance, is somewhat purblind, and the Pupil being then much dilated, must greatly increase the Luxuriancy of the Picture: But if this same Candle be viewed in Day-light, or even if it be viewed by Night from a well lighted Room, or if a

Flash

Flash of Lightning should happen at the Time it is viewed, it will not appear much bigger than it ought, by reason of the Contraction of the Pupil, which corrects the Luxuriancy of its Picture on the *Retina*.

As for what concerns the Spots that are so frequently observed by myopical Eyes; these may proceed from some little Extravasations, varicous Swellings, or other Defects in the *Retina*, which, by intercepting the Rays, will occasion a Defect in the Picture, and by Consequence, a similar and corresponding Defect or Spot in the Object. These Spots commonly vanish, or at least become less sensible, when the Object is brought nearer the Eye, and within the Limits of distinct Vision; for the Rays, which are now exactly united upon the *Retina*, by being more crowded, have their Force augmented; by which means, a sensible Impression is made upon the *Retina* through these Extravasations, which are too thin to intercept wholly these Impressions, unless when they are weak and faint: And this is the Reason why these Spots are always most sensible to those who have a small Pupil, and especially to those who are short or long-sighted: From which also we may see, why in a presbytical Eye the Spots, which were formerly very sensible, become so faint, when the Object is viewed through a convex Glass of a due Degree of Convexity; for by means of this Glass more Rays are made to enter the Eye, which being united exactly at its Bottom, must strike the *Retina* strongly enough for to make a sensible Impression through these Extravasations, which

will render the Spots so faint and obscure, as to be scarce any more observable. And what has been said with respect to these Spots, when occasioned by small Extravasations, or other Defects in the *Retina* that intercept the Rays, will also hold, when they are occasioned by a Callosity, or any Degree of Paralysis or Insensibility in some Parts of the *Retina*, by which the Impulse or Stroke received from the Rays is made less sensible.

But besides these Defects in the *Retina*, there is yet another Cause which may give Occasion to those Spots both in the *Myopia* and *Visus senilis*, and that is certain small opaque Marks on the *Cornea* itself, or any where within the Eye, which, by intercepting some of the Rays, must occasion a Defect in the Picture, from which Defect a kind of dark Spot will be seen in the Object. Thus in the Eye of a *Myops*, (See Fig. 10.) if there is any Opacity in the *Cornea*, or within the Eye, which intercepts the Rays *Bbe*, *Ccd*, and *VLa*, there will be a Defect in the Picture at *e*, *d* and *a*, from which also the external Appearance will be deficient at the corresponding Points *E*, *D* and *A*, where, by Consequence, dark Spots will be seen : For it is here to be observed, that there is not one Point in the Picture that is formed by a Plurality of Rays which convene at that Point, but every Ray goes to a different Point of the Picture, both in myopical and presbytical Eyes ; and therefore, when any of the Rays are intercepted, that Part of the Picture to which such Rays belong, will not be illuminated, which must occasion a corresponding Defect in the

Appearance

Appearance of the Object; but in the *Visus perfectus*, where the Rays that come from the several Points of the Object are so refracted as to meet again at so many corresponding Points in the *Retina*, every Point of the Picture is formed by a Cone or Pencil of Rays, whose Basis is the Pupil; and therefore tho' some of those Rays be intercepted, yet no Part of the Picture will be darkned, and consequently no Defect will be seen in the Object from any such Opacity in the *Cornea* or Humours of the Eye, unless this Opacity be in the back Part of the vitrous Humour, where the Pencil is narrow, and intercepts the whole Pencil.

If any desire an experimental Proof of this, let them repair to a *Camera obscura*; and having made some dark Spots in the *Lens*, by applying Patches, or any such like small opaque Bodies, let this Glass be placed at a round Hole made in the Window-shut of the dark Chamber for refracting the Light which comes from an Object without Doors, so as its Picture may be painted on a Sheet of white Paper, placed behind the *Lens*; if this Paper be at a due focal Distance from the *Lens*, no Defect or Spot will be found in the Picture; but if the Distance of the Paper be greater or smaller, than that at which the Rays conveen, for making the Picture distinct, as many dark Marks will be seen in the Picture as there are Spots in the Glass: And it is only from this Principle that any satisfactory Account can be given how it comes to pass, that when a small opaque Body, that is, a Body that is less than the Pupil, is held close to the Eye, before which several Candles

are placed at a great Distance, suppose sixty Feet, if the Eye attend to this small Object, or, which is the same Thing, if it endeavour to accommodate itself to its Distance, this Object will be seen multiplied according to the Number of Candles, and will appear like a dark Spot in each of the Candles. This Phænomenon seems very extraordinary to such as have no Knowledge in Opticks; but from the Principles already established, it admits of a most easy Solution. For when the Eye endeavours to see the small Object, it becomes myopical with respect to the Candles; and therefore on each of their Pictures on the *Retina*, the dark Shade of the interposed Body will be cast; from which a corresponding dark Spot must be seen in each of the Candles: But when the Eye does not attend to this small Body, but is well disposed for seeing the Candles distinctly, this interposed Body will not be multiplied, nor will any dark Mark be seen in any of the Candles, because every Point of their Pictures is now composed of a Cone or Pencil of Rays, which after Refraction are made to conveen at that Point; and therefore, tho' some of the Rays belonging to each Pencil are intercepted, yet every Point of the Picture will be sufficiently, and indeed equally illuminated by the Rays that are not intercepted; and consequently no Defect or Obscurity will be seen in any Part of the Candles, and the small opaque Body will itself seem perfectly diaphanous.

9^o, Another Phænomenon belonging to *Myopes* is, that they read and write very small Characters, by reason that the visual Angle is enlarged by the Proximity of the Object:

Whence

Whence also it is, that great Characters fatigue their Eyes, because of the Motion that is required to run over a Word.

10mo, In reading, they generally hold the Book towards the Side of their Head, that it may be sufficiently illuminated and not darkened by the Shade of their Head.

11mo, No Object being distinctly seen but what is very nigh, in order to see it with both Eyes, their Axes must be very converging; which Situation of their Eyes being painful and laborious, because of the strong Effort that must be exerted by the adducent Muscles, they are oftentimes obliged to turn away one of their Eyes; whence proceeds a double Vision, which in reading, does frequently oblige them to shut one of their Eyes, that they may avoid the Confusion that is occasioned thereby.

12mo, There is yet another Phænomenon which happens to all Kinds of Sights, but it is commonly a great deal more sensible to those that are purblind than to others, because that in them the *Cornea* is more convex and elevated, *viz.* they see an Object that they do not look at, and they do not see this same Object when their Eyes are turned towards it. This seems a Paradox in Opticks, but it is agreeable to Experience; for having applied to the Side of the Head any thin black Body, such as the Brim of a Hat, so as it may abscond the Objects that are upon that Side: Without moving the Eye, turn the Head with the black Body that is fixed to its Side, till you shall perceive a certain small white Object placed upon a black or brown Ground; then keeping the Head fixed

in this Situation, let the Eye be directed to the Object, and it will vanish.

This Experiment is apt to surprise at first, but it is very easy to account for it from the Conformation of the Eye; for if AIK (Fig. 11.) be the Eye, BL the black Body plac'd near to the Eye, and if O be the white Object, the Pupil *fc* being turned towards M: The Rays which come from the Object O, in passing by the black Body BL, will fall obliquely upon the *Cornea* at A, and will be refracted in the aqueous Humour, so as to pass through the *Pupil fc*, and consequently will fall upon some Part of the *Retina*; by which means the Object O will be seen, though the Eye is not directed to it: But if, without moving the Head, the Eye be turned towards O, it must move nearly upon its Center H, from which the *Cornea* and *Pupil* will get the Position given them in the Figure; and therefore, though even in this Position of the Eye, the Rays that come from O, and that pass over the Extremity of the Obstacle at B, should be supposed to fall upon the *Cornea*, yet by reason of the Obliquity of their Incidence, they can never be so refracted as to enter the Pupil ED, but must be all lost upon the *Uvea*; from whence it is evident, that the Object O will not be seen when the Eye is directed to it.

I have done with the Short-sight, and shall now shortly explain the Phænomena that belong to the weak or presbytical Sight. *Presbytæ*, or weak-sighted People, are such as have the *Cornea* and Crystalline, or either of them, too flat, in Proportion to the Distance betwixt the *Crystalline* and *Retina*: From which Fault in the Con-

for-

formation of their Eyes, it clearly follows, that

1mo, The Rays of Light that come from the several Points of an Object at an ordinary Distance, will not be sufficiently refracted, and for want of sufficient Refraction will not meet at the *Retina*, but beyond it; and therefore the Picture on the *Retina*, and the Vision caused thereby will be imperfect and undistinct, more or less, as the Object is nearer or further off. Whence,

2do, In order to read, they must remove the Book to the Distance of two or three Feet, whereas in their Youth they used to read at one Foot distance. But,

3to, As the Picture on the *Retina*, and the visual Angle under which the Object is seen are then lessened, and that in Proportion as the Distance of the Object is increased; it is evident that small Objects will not be seen well, even when their Distance is such as is necessary for making their Picture on the *Retina* distinct. Whence it is, that sometimes they cannot read at all, especially if the Characters be small, without the Assistance of Spectacles; which are still the more necessary, because that when the Object is at a Distance, less Light enters the Eye, and consequently the Picture, and the Impression made on the *Retina* thereby will be fainter.

But for a fuller Explication of this Point, and to show how small Objects may become invisible to the naked Eye, even when their Picture is distinct upon the *Retina*, it must be observed that there is a *minimum visibile*, and that all Objects, however small, if at all seen, are seen of that Bigness. For the *Retina* being composed of small Fibres, not unlike a Piece of

of Plush, with the Ends of the Threads turned towards the Crystalline, all the other Ends of them being terminated in the Brain, there can be no more distinct Sensations than there are distinct Threads to convey the Impression on them, and the Eye will be incapable of distinguishing the Parts of any Picture that is no bigger than one of these Fibres composing the *Retina*; so that if any Object be so far removed from the Eye, as to make the Picture of it on the *Retina* less than one single Fibre, that Object becomes invisible, if it be but of a dull Radiation, because of the Weakness of the Impression made on the Fibre; but if it be of a very bright and powerful Radiation, the whole Filament is moved, by having one Part of it powerfully acted on, and therefore the Sensation is the same as if the Object were much bigger, and did take up or cover the whole End of the Filament: And this to me seems to be the Reason why the Stars appear all of the same Bigness, and why even to the naked Eye they appear many thousand times bigger than really they are, and even as big as through a long Telescope, which would not be, if our Sight were sufficiently fine and nice. I have said, that when an Object is so far removed from the Eye, as to make the Picture of it on the *Retina* less than one single Fibre, that Object becomes invisible, if it be of a dull Radiation, by reason of the Weakness of the Impression: For the Strength of the Impression, when the Picture covers the whole End of the Fibre, will be to its Strength, when it only covers a Part of it, as the Magnitude of the whole Fibre is to the Magnitude

gnitude of that Part of it that is taken up by the Picture.

But there is yet another Reason, why an Object is not seen, when its Picture is less than one single Fibre, and that is, that this same Fibre does not only receive an Impression from this Object, but it does also receive an Impression from the extreme Parts of the contiguous Objects by which it is terminated; which, if they be of a bright Radiation, must prevail over the other Impression, and, by their Prevalence, render the Object itself invisible: Thus, if one of the Fibres composing the *Retina*, be supposed as big as αo , (Fig. 12.) the small Objects IE will, on the *Retina*, make a Picture betwixt i and e , and the contiguous Objects OI and AE will on the same Fibre αo , form a Picture at oi , and ae , which being white will act more powerfully on the Fibre αo , than does the Picture of the small black Object IE, and consequently this same Object IE must become invisible, and the more bright and luminous Bodies OI and AE must appear extended over all the Space OIEA. The learned Dr. Hook by an easy Experiment found the *minimum visibile* in most Eyes to be comprehended within an Angle of one Minute, (See his *posthumous Works*, p. 12. and 97.) Whence it is, that whatever is seen, is seen of that Bigness, or under that Angle: Thus every Star that the Eye discovers appears to be of the Bigness of a Minute at least, and so it is conceived really to be; though yet when we come to examine its Diameter by the Help of a Telescope, we really find it to be but some few Seconds, or 60 Parts of such an Angle: And this also is
the

the Reason why, if there be two, three, or a hundred small Stars so near together, as that they are all comprised within the Angle of one Minute, the Eye has a Sensation of them all as if they were one Star, and distinguishes them not one from another; because all their Pictures, falling upon the same nervous Fibre, make but one Impression on the *Sensorium*; which being strong and powerful prevails over, and destroys the more faint and languid Impression made by the Picture of the Interval that is betwixt them: And the Case is exactly the same when an old Man removes the Book to a very great Distance from his Eyes; for if the black Lines forming the Letters are seen under a less Angle than a Minute, they will be wholly obliterated by the more powerful Impressions of the white Paper that terminates them.

And here by the way it may not be improper to observe, that this Experiment of Dr. Hook's serving to determine the *minimum visibile* affords us a pretty certain Proof of the Magnitude of our nervous Fibres: For if *ao* (Fig. 12.) be the End of one single Fibre, the small Object *IE*, which is here supposed to be bright and luminous, will, by means of its Picture on the *Retina ie*, move the whole Fibre, and the Appearance of the Object will be the same as if its Picture were extended over the whole End of the Fibre *ao*; and therefore, if from the extreme Points of the Fibre *a* and *o*, the right Lines *ax A*, *ox O* are drawn thro' the Center of the Eye *x*, these Lines will be perpendicular to the *Retina* at the Points *a* and *o*, and consequently the small Object *IE* will be seen under
the

the Angle Ox A; which Angle being given, the Angle $\alpha x a$, which is equal to it (both being Angles at the Vertex x) will also be known, from which the Diameter of the nervous Fibre ao may easily be found. Thus if the Angle Ox A be one Minute, as Dr. *Hook* found it in most Eyes, though there were some that could see to the third of a Minute, the Angle $\alpha x a$ will also be one Minute, which is the 60th Part of a Degree, or the 21,600 Part of a Circle: Whence if the Eye be supposed to be one Inch Diameter, or three Inches in Circumference, the Diameter of the nervous Fibre ao will be the 21,600 Part of three Inches, or the 7200 Part of one Inch, which is the 600 Part of a Line; and if ten Hair-breadths make a Line, which is pretty near the Truth, its Diameter will not exceed the 60 Part of the Diameter of a Hair: Whence the nervous Fibres themselves will be no bigger than the 3,600 Part of an ordinary Hair. And if it be supposed that one can see under an Angle that is no bigger than the third of a Minute, as Dr. *Hook* found that some could do, then the Bigness of the nervous Fibres composing the *Retina* will not exceed the 32,400 Part of an ordinary Hair, which is a surprising and almost inconceivable Smallness; and the more, because each of these Fibres are supposed hollow Canals or Tubes in which the Spirits flow. How fine and subtile must then the Spirits themselves be? But this is not all; for if Birds can see distant Objects as well as Man, which seems very probable, because of the Facility which they have, in returning to Places at a great Distance from which they had gone,

gone, and especially because Birds of Prey are observed to perceive very small Animals at a great Distance; I say, supposing that Birds see Objects at a Distance as well as we do, it is necessary that the Fibres which compose their optick Nerves and *Retina*, be much more fine and delicate than in Men; for since their Eyes are smaller than ours, the Image of Objects on the *Retina* will also be smaller: Whence it is manifest, that a similar Conformation of the Humours is not alone sufficient to make an equal Perfection in the Sight: For Instance, an Eye of two Lines Diameter, (than which there are many smaller) which has the Humours of a similar or like Figure to those of a human Eye, whose Diameter is an Inch, can never see Objects at a great Distance as distinctly as we do, unless the Organ of Sight on which the Pictures of Objects are received, be 36 times finer and more sensible than it is in our Eyes: For the Picture of the Object will be 36 times smaller in their small Eye than in ours, the Surfaces of the Globes of their Eyes being to one another as 1 is to 36. And therefore, if the nervous Fibres of our *Retina* do not exceed the 32,400 Part of a Hair, in Animals, whose Eyes are only two Lines Diameter, they will be no bigger than the 1,166,400 Part of an ordinary Hair, which is truly a prodigiously surprising and almost incredible Smallness; and yet upon Calculation, it is as certain as any Proposition in *Euclid*, that they can be no bigger, if we allow them to see Objects at a Distance as distinctly as Men do. But I must go forward.

4to, They who are long-sighted require more Light than others for enabling them to read; for being obliged to remove the Book to a considerable Distance, that the Rays which come from the several Points of the Object may meet again in so many correspondent Points on the *Retina*, without which there can be no distinct Vision, less Light will enter the Eye, and the Impression made thereby on the *Retina* will be too faint; unless the Object be more strongly illuminated, than what is necessary either in the short or perfect Sight; in both which, the Proximity of the Object does in some Measure recompense its Obscurity. Add to this, that in the presbytical Eye the Pupil is always smaller, on which Account also more Light will be required for making a sufficient Impression on the *Retina*. And this is the Reason why,

5to, The presbytical Eye receives greater Benefit from the Use of a convex Lens, than the Eye of a Myops does from one that is concave: For the Property of such Glasses being to collect the Rays, more of them will be made to enter the Pupil; and as in such Eyes the Refraction is too weak, the Rays which flow from a Point at an ordinary Distance, and which, for want of sufficient Refraction, do not concur at the *Retina*, but at some Place beyond it, will by means of this Glass be made to meet at the *Retina*: Whence they that are long-sighted must receive a double Advantage from convex Glasses; for by them the Picture is not only distinct upon the *Retina*, but is also as strong and lively as if the Pupil had been much larger.

6to, Long-sighted People see more distinctly through a small Hole, such as that made by a Pin in a Card; for by this Hole the Picture will be rendered more distinct upon the *Retina*, and that for the same Reason that has been given, why in a *Myops* the Sight is mended, by looking through a small Hole: But as Part of the Light is intercepted by the Card, and as long-sighted People require more Light than others for rendring their Sight equally clear, they will not reap so much Advantage from the Interposition of the perforated Card as those who are short-sighted, and who by reason of the Proximity of the Object can easily read in the Twilight, when such as have not that Defect in their Eyes, cannot distinguish one Letter from another.

7mo, They who are long-sighted commonly become more so as they advance in Years; for the *Cornea* and *Crystalline* become flatter and flatter continually, because of the daily Waste and Decay that happens in the Humours of the Eye; whence at last they cannot see at all without the Assistance of Spectacles, which supply the Refraction that is wanting in the Eye, by rendring the Rays converging, which can never be done by the alone Position of the Object from which they proceed: For if it is near, they enter the Eye diverging; and if it is far off, they enter nearly parallel. But though the presbyterian Eye does commonly become more and more so by Degrees; yet some have been found who at last recover their Sight again, and have no further Occasion for their Glasses to enable them to read. There are many Causes which

which may produce this Effect, but to me it seems probable that it should chiefly arise from a Decay of the Fat in the Bottom of the Orbit; whence the Eye, for want of the usual Pressure at its Fund, is by the Pressure of the Muscles and Fat towards the Sides of the Eye, reduced to an oblong Figure, by which the *Retina* is removed to a due focal Distance from the *Crystalline*. From this it is easy to see, how, from a contrary Cause, the Sight, which was perfect till about the twentieth or twenty fifth Year of their Age, does in some for a certain Time after that become more and more myopical by Degrees: For if at this Time the Muscles of the Eye become bigger and more fleshy than before, or if the Fat should be collected in greater Plenty towards the Side of the Eye, the Eye will, by reason of the Pressure on its Sides, be reduced to an oblong Figure, and the *Retina* will be pushed back to too great a Distance from the *Crystalline*, which obliges them to bring the Object they would see distinctly nearer to their Eyes, that its Picture may be distinct upon the *Retina*; whereas, before that, they used to read at an ordinary Distance.

8vo, In the presbytical or weak Sight, as well as in that which is perfect, the Eye is more sensibly affected, and suffers more by great Light than when the Sight is myopical with the same opening of the Pupil; for the luminous Bodies that surround us, and which are not very near us, send Rays into the Eye, which in the *Visus perfectus* are brought together, and united upon the *Retina*, and make but a very small Base in the presbytical Eye; whence the

Impression made on the *Retina* will be strong and lively in both these Eyes, and must therein cause some Pain or Uneasiness, which does not happen in the myopical Sight, because these same Rays make a larger Base on the *Retina*; for all Things being equal, the myopical Eye always sees Objects more confusedly than does either the perfect or presbytical Eye, and this Confusion is caused by the Space which the Rays that come from each Point of the Object occupy on the Fund of the Eye. And this by the by is another Reason why the Pupil, which in Children is very large, continues more so in those who are short-sighted, than in those whose Sight is either perfect or weak, and who by reason of the too strong Impression made upon the *Retina*, by bright and luminous Objects, are obliged to contract the Pupil, for keeping out a Part of the Light.

9no, To a presbytical Eye, small lucid Objects, such as a lighted Candle, or a small Hole of a Line or two Diameter, which is luminous, because of the Light which passes it, appear big and round; and if the Rays on either Side of the Pupil be intercepted by the Interposition of any opaque Body, the opposite Side of the Appearance will be hid, and the opaque Body itself will appear as if it were on the contrary Side to that where it really is.

This Phænomenon will, no doubt, seem very extraordinary to some; for since we always judge that Objects are in a contrary Position to that of their Pictures on the *Retina*, in the present Case it would seem that the Order of Nature is inverted, for by this Experiment we ought

ought to conclude, that the Object forms its Picture on that Side of the *Retina* on which it is, which is altogether contrary to all the Laws of Opticks, and to all our other Experiences.

For explaining this Phænomenon, see Fig. 13. where the Candle A is the small luminous Object, BCde the Eye, and *a* the Point of Concourse, where the Rays AB, AC, &c. that come from the Point A, are united behind the *Retina*; these Rays being cut by the *Retina* before their Reunion, will thereon form the large Image *ed*, which by reason of the round Figure of the Pupil will also be round, whence the Candle itself will likewise appear round, and of a Bigness answerable to the Bigness of its luxuriant Image; for by means of the Impression at *e*, it will be seen at E in the right Line *exE*, which being drawn through the Center of the Eye *x*, is perpendicular to the *Retina* at the Point *e*, and by means of the Impression at *d*, it will be seen at D in the right Line *dxD*; which being drawn through the Center of the Eye *x*, is also perpendicular to the *Retina* at the Point *d*, and by means of the other Impressions made by the other Rays forming the circular Picture *ed*, it will be seen in the other Points of the Circle AED described about the Center A, with the Radius AD or AE, and consequently will appear big and round: And if by the Interposition of the opaque Body F, the Ray AC be intercepted, there will be a Defect in the Picture at *d*, and consequently a similar Defect in the Appearance at D; and therefore if this same Body F be slowly moved from C to f, this Defect in the Picture will, by De-

grees, extend itself from *d* to *o*, by which a similar Defect in the Appearance will be made to extend itself from *D* to *A*, insomuch, that when the Extremity of the opaque Body *F* has, by moving from *C* to *f*, come to *f*, the half of the Picture at *do*, and the corresponding half of the Appearance *DA* will be made to vanish, and the Candle will get a semicircular Appearance at *AE*: Whence it is easy to see, that the opaque Body itself *F* must appear as if it were on the contrary Side to that where it really is; for being moved from *C* to *f*, it will have the Appearance of a dark Shade that is moved from *D* to *A*.

10mo, The last Phænomenon that I shall notice, is the little Spots or Marks that long-sighted People are so liable to see before their Eyes. I have already enquired into the Cause of these Spots, and have shown that when the Eye sees distinctly, no Spots will appear, unless there be some Defect in the *Retina* itself: But both in the *Visus senilis* and *Myopia*, certain dark Spots or Marks will also be seen, when there are any small opaque Marks on the *Cornea*, or any where within the Eye, that intercept some of the Rays in their Passage to the *Retina*; whence such Eyes may be said to see all their own Defects, which does not commonly happen when the Eye sees distinctly, because then the Rays that come from a Point in the Object are exactly united in a corresponding Point in the *Retina*; and therefore though some of them be intercepted, yet that Point will be seen by means of those that pass; yet if any such opaque Spot be in the Back-part of

the

the vitrous Humour where the Pencil is narrow, and intercept the whole Pencil, the corresponding Point of the Object will be darkned. These Spots or Marks are not all of the same Kind, there are some which may be called *fixt* and *permanent*, because they do not change their Place with respect to the Axis of Vision, and these must proceed from some Defect either in the *Retina* or *Cornea*, or in the *vitrous* and *crystalline* Humours. Others there are which may be called *fluctuating* and *inconstant*, because they are in constant Motion, and change their Place continually; and these must arise from some Corpuscles floating in the aqueous Humour, which, being thin like Water, does not hinder them from changing their Situation; but whether they are fixt or moving, they must always appear like dark Marks or Defects in the Object, and that as well when they proceed from opaque Spots on the *Cornea*, or any where within the Eye, as when they proceed from the above observed Defects in the *Retina* itself.

And this leads me to explain another Kind of Spots that are very common in the presbytical Sight, and which are not dark and shady, like those that have been already accounted for, but more bright and luminous than the Object itself before which they appear. These Spots appear best in looking to bright Objects at a considerable Distance, and are always of the same Colour with the Object before which they are seen. In the Middle their Colour is clear and strong, which is surrounded by a dark and shady Border, not unlike the Knots of a polish-

ed Fir-board. They are commonly accompanied with certain irregular Veins that proceed from each Spot, and which as well as the Spots themselves, change their Order and Disposition. These Veins are also of the same Colour with the Object, and being bright and luminous in the Middle, are likewise terminated by a dark and obscure Edge, as may be seen at Fig. 14. These Spots and Veins do not always remain in the same Place, but change their Position with respect to the *Axis of Vision*, according as the Eye is differently moved, being sometimes in the *Axis of Vision* itself, and at other Times to the right or left of this same Axis; but when the Eye is kept fixt in the same Direction, they commonly descend gradually.

As for what concerns the Cause of these Spots and Veins, it seems evident, that *1mo*, They must proceed from some Corpuscles within the Eye, which are at Liberty to change their Place, and which therefore must be supposed to float in the aqueous Humour. *2do*, Seeing these Spots do always descend when the Eye is kept fixt and immoveable, the Corpuscles from which they arise must ascend, and consequently are lighter than the aqueous Humour in which they swim. *3to*, These Spots being more bright and luminous than the Object itself before which they are seen, they cannot be occasioned by any opaque Corpuscles, which by intercepting the Rays do cast a Shade upon the *Retina*. For from such Corpuscles the Spots would appear like Defects or dark Marks on the Object, as has been shown above. What therefore seems

to bid fairest for producing these Spots and Veins, is small, oily, diaphanous Particles and Filaments, that swim in the aqueous Humour before the Crystalline; for such Particles and Filaments, by reason of their Lightness, will mount upward, when they are left to themselves, and are not disturbed by the Motion of the Eye, and by their greater refractive Power, they will produce these luminous Spots and Veins, terminated by dark and shady Borders. That oily and sulphureous Substances, though less dense than Water, have a stronger refractive Power, is evident from the Observations of the incomparable *Newton*, who, in his admirable *Treatise of Opticks*, has given us an exact Table shewing the Refractions of almost all Kinds of Bodies, by which it appears, that the refractive Power of unctuous and sulphureous Substances is two or three Times greater, in respect of their Densities, than the refractive Powers of Glass and other terrestrial alkalizate Concrets; and that Rain-water, with which the aqueous Humour may be supposed to agree, has a refractive Power, in a middle Degree, between those two Sorts of Substances. From which it follows, that the Rays of Light which pass through these oily Particles, suffer a much greater Refraction, and by consequence will meet sooner behind the *Crystalline*, than the Rays that pass by and do not meet with such Particles: Whence if the Conformation of the Eye be such as renders it *presbytical*, the Rays of Light that come from the several Points of the Object will not converge to so many other Points in the *Retina*, but behind it, by which

the

the Picture on the *Retina*, and the Vision caused thereby, will be rendered more dark and obscure; but the Rays which pass through these oily Grains and Filaments, by having their Refraction increased, will be made to meet nearly at the *Retina*, where they will form small luminous Spots and Veins, surrounded with dark and shady Borders; just as a convex Glass, when exposed to the Sun, forms its luminous Focus in the Middle of a very strong Shade with which it is environed. For as Light is not generated when ever we see it increased, it is by robbing some other Part of its Light, or by bringing the Light that should have been diffused over some other Part to the more enlightened Place. When therefore the Rays of Light that pass through these oily Particles and Veins are so refracted as to conveen at the *Retina*, and paint thereon small luminous Spots and Veins, these Spots and Veins will be terminated by a dark and shady Edge, because the Light which should have illuminated the Edge is now made to fall on the luminous Picture: And this you see, how in the *presbyterian Eye*, small luminous Spots and Veins, encompassed with dark and shady Borders, may be painted on the *Retina*, and how from such Pictures, similar and like Spots and Veins will be seen moving before the Object.

From what has been now said concerning the Phænomena that are peculiar to the *short* and *long Sight*, it is easy to deduce the many Advantages that accrue to us from the Motion of the *Crystalline Humour*; for it being by the Motion of this Humour that our Eyes are fitted

for

for seeing distinctly at different Distances, had we been denied the Power of changing its Situation, there could have been no distinct Vision, but at one determined Distance, either great, middle, or small, according to the particular Disposition of our Eyes; and with respect to all Objects at a greater or lesser Distance, the Sight would have been *myopical* or *presbytical*, and consequently would have been liable to all the Symptoms, Defects and Inconveniences above explained. But,

2d^o, Besides the Advantage we receive from the Mobility of the *Crystalline*, in enabling us to see distinctly at different Distances, there is yet another taken notice of by the greatest Part of our optical Writers, which consists in enabling us to judge with more Certainty of the Distance of Objects.

There are six Things whereby we are enabled to discover the Distance of Objects, all which I have promised to explain, in order that it may thence appear, that when with one Eye, the other being shut, an Object is viewed through small Holes made in a Card, we can scarce form any Judgment with respect to its Distance, but what is founded on Prejudice and Anticipation, as has been affirmed above.

The *first Mean* whereby the Mind judgeth of Distance, consists in that Disposition of the Eye that is necessary for seeing distinctly at different Distances. We have already demonstrated, that there can be no distinct Vision, unless the Rays of Light, which are sent from the several Points of the Object, be, by the Humours of the Eye, refracted and brought together

ther in so many corresponding Points on the *Retina*; and that the same Conformation in the Eye is not able to perform this Effect, but must be changed by the Contraction of the *Ligamentum ciliare*, which being sensible to us, because it depends upon our Mind which regulates it, will enable us in some Measure to judge of Distances even with one Eye; as for Instance, when I view an Object at seven Inches Distance, I distinguish its Distance by the Disposition of the Eye, which at that Distance is not only sensible, but in some sort uneasy: And when the same Object is viewed at twenty seven Inches Distance, the Distance is still perceived, because the necessary Disposition of the Eye is still sensible, though no longer uneasy. And thus you see how, with one Eye alone, we judge of lesser Distances from the Change which happens in the Conformation of the Eye; but as this Change in the Conformation of the Eye has its Limits beyond which it cannot go, it can be of no Use in assisting us to judge of the Distance of Objects placed without the Limits of *distinct Vision*, which in my Eyes reach no further than from seven to twenty seven Inches: But as the Object does then appear more or less confused, according as it is more or less removed from these Limits, this Confusion supplies the Place of the Motion of the Crystalline, in aiding the Mind to judge of the Distance of the Object, it being always esteemed so much the nearer or further off, by how much the Confusion is greater; but this Confusion has its Limits also, beyond which it can never extend: For when an Object is placed at a certain

Distance

Distance from the Eye, to which the Breadth of the Pupil bears no sensible Proportion, the Rays of Light that come from a Point in the Object, and pass the Pupil, are so little diverging, that they may in a physical, though not mathematical Sense, be looked on as parallel; and therefore the Picture on the *Retina* will not to Sense become more confused, though the Object be removed to a much greater Distance. What this Distance is to which the Diameter of the Pupil bears no sensible Proportion, Authors are not agreed on, nor shall I at present take upon me to determine; but considering the Smallness of the Pupil, it is obvious that it cannot reach any far Way; and consequently this Confusion in the Appearance of Objects can only assist us in judging of small Distances.

The *second*, most universal, and frequently the most sure *Mean* we have for judging of the Distance of Objects, is the Angle made by [the *optick Axes* at that Part of the Object on which our Eyes are fixed: For our two Eyes are like two different Stations in *Longimetry*, by the Assistance of which, Distances are taken, as hath been explained in the former Part of this Essay. And this is the Reason why those that are blind of one Eye do so frequently miss their Mark in pouring Liquor into a Glass, snuffing a Candle, and such other Actions as require that the Distance be exactly distinguished; of which Mr. *Boyle* has given several Instances, in his Observations upon the vitiated Sight.

The *third Mean* for judging of the Distance of Objects, consists in their apparent Magnitudes,

tudes, or the Magnitude of their Image painted upon the *Retina*. The Diameter of these Images does always diminish in Proportion as the Distance of the Object they represent does increase; and therefore, from this Change in the Magnitude of the Image, we easily judge of the Distance of Objects, as often as we are otherwise acquainted with the Magnitude of the Objects themselves. And this is the Reason why Painters do always diminish the Magnitude of Objects in their Pictures, in Proportion as they would have them appear at a greater Distance. But, as often as we are ignorant of the real Magnitude of Bodies, we can never, from their apparent Magnitude, or the Magnitude of their Image on the *Retina*, form any Judgment of their Distance; and this is one Reason why the Stars do all appear of the same Distance, though it is certain that some are vastly nearer than others. For there are an Infinity of Objects whose Distance we can never perceive, because we are intirely ignorant of their Magnitude.

The fourth Thing whereby we judge of the Distance of Objects, is the Force wherewith their Colour acts upon our Eyes: For if we are assured that two Objects are of a similar and like Colour, and that the one appears more bright and lively than the other, we judge by Experience that the Object that appears most bright is nearer than the other.

There are some who, in explaining this Matter, would have us believe, that the Force wherewith the Colour of Objects strikes our Eyes must decrease in a reciprocal duplicate Proportion of their Distances, because the Intensity

tensity and Vigour of Light does always decrease in that Proportion. That the Intensity or Vigour of Light does always decrease in a reciprocal duplicate Proportion of the Distances from the radiant Point, I readily acknowledge; for since the Light is diffused spherically, like Rays drawn from the Center to the Circumference, its Intensity at any given Distance from its Center of Activity will be proportional to the Density of its Rays at that Distance; and therefore, if A (Fig. 15.) be any radiant or visible Point, and if ABE, ACF, ADG, &c. represent the Rays flowing spherically therefrom, the Rays, which at the Distance AB, are diffused through the spherical Surface BCD, at the Distance of AE are dispersed through the whole spherical Surface EFG; but the Density of any given Quantity of Rays is reciprocally as the Spaces they occupy; that is, if the Surface EFG be double the Surface BCD, the Rays at the Surface BCD will be twice as thick or dense as the same Rays at the Surface EFG; and if the Surface EFG be triple the Surface BCD, the Rays at BCD will also be three times denser than the same Rays at the Surface EFG; and universally, whatever Proportion the Surface EFG has to the Surface BCD, the same Proportion will reciprocally obtain betwixt the Density of the Rays at the Surface BCD and the Surface EFG: But (as is manifest from *Archimedes de Sphera & Cylindro*) the Surfaces of Spheres are in a duplicate Proportion of their Diameters or Radii; and therefore the Thickness or Density of the Rays, at the Distance AB, is to their Density at the Distance AE, in a

reciprocal duplicate Proportion of the Semidiameter or Distance AE to the Semidiameter or Distance AB: But, as has been already said, the Vigour or Intensity of Light, in any given Distance, is always as the Density of its Rays at that Distance; and therefore the Intensity of Light at any Distance as AB, will be to its Intenseness at any other Distance, as AE, in a reciprocal duplicate Proportion of the Distance AE to the Distance AB; that is, as the Square of AE is to the Square of AB.

But tho' the Intensity and Vigour of Light does thus decrease in a reciprocal duplicate Proportion of the Distances from the radiant Point, it does not from thence follow, that the Force wherewith Objects act upon our Sight, does also decrease in the same Proportion; and that for this obvious Reason, *viz.* That as the Intensity of Light decreases by the Distance of the Object, so does the Magnitude of the Image upon the *Retina* also decrease in the same Proportion; and therefore this Image will be as strong and lively, and will act as powerfully upon the *Retina*, when the Object is at a Distance, as when it is near; and consequently the Object will at all Distances appear equally clear and luminous, unless there be some other Cause that can make it otherwise.

For understanding what this Cause is, we need only let into a darkned Chamber, through a small Hole in the Window-shut, a Beam of the Sun's Light: For this Beam being seen like a luminous Path, in all Positions of the Eye, it is evident that the whole Light does not go forward in its rectilineal Course, but that at all Points

Points of the Medium through which it passes, some Part of it is reflected every Way, by means of which the Beam becomes visible; and therefore this same Beam, by reason of the continual Diminution made in its Light, must grow weaker and weaker continually, and that in Proportion to the Opacity of the Medium through which it passes. If the Air be pure and clear, little Light will be reflected and more will be transmitted. If it be moist or smoaky, more will be reflected and less transmitted. But be it never so clear, some Part of the Light will always be reflected or stifled in its Passage; and consequently its Intensity must always decrease in Proportion to the Distance of the Object from which it flows. Seeing then the Intensity and Vigour of Light does thus continually decrease, according as the Distance of the Object increases; it follows that Objects must always appear less luminous, and more ting'd with the Colour of the Medium through which they are seen, the further they are removed from our Eyes; and therefore, when we are otherwise assured, that two Objects are of the same Colour, if the one appear more bright and lively than the other, we are taught by Experience to conclude, that that which appears most bright is the nearest; and it is for this Reason that luminous and strongly illustrated Bodies do always appear nearer than really they are. Whence it is easy to see why a Chamber appears less when its Walls are whitened, and why the Fields and Hills appear less when covered with Snow: For, in these and such like Cases, the Brightness and Strength of

Colour makes them seem nearer; from which we conclude they are smaller: For we always judge of the Extension and Magnitude of Bodies, by comparing their apparent Magnitude with their Distance. From this also, we may see why Fire and Flame appear so small when they are seen at a Distance in the Night-time: For the *Pupil* being then much dilated, more Light will enter the Eye, which, by acting more powerfully on the *Retina*, must make the Object appear much nearer, from which it will be judged smaller.

And as bright and luminous Bodies appear nearer, and less than they really are, so, on the contrary, dark Objects, and Objects that are faintly illuminated, do always appear further off and greater, by reason of the Faintness and Obscurity of their Colour. This is particularly observable, when dark Bodies are seen in the Twilight, which always seem further off and greater, than when seen in the brighter Light of Day. And it is also for the like Reason, that the apparent Distance and Magnitude of Objects are increased when seen in misty Weather: For much Light being intercepted or scattered irregularly in its Passage through the Mist, less of it will enter the *Pupil*, and consequently it will act less forcibly on the *Retina*, from which the Object will be esteemed at a greater Distance, and bigger than it ought. And indeed the Deception of Sight arising from this Cause is so great, that I have been told, that a distant Sheep has sometimes in a misty Day been mistaken for a Horse. And this Opacity of the Atmosphere, which hinders Part

of the Light from coming to the Eye, is also the Reason why the Sun, Moon and Stars appear very faint when near the Horizon, and brighter continually as they rise higher: For the Tract of Air and Vapours, which lies in the Way of the Rays, is longest and thickest near the Horizon, and becomes thinner and shorter as the Objects rise higher, and consequently does less obstruct the Passage of the Rays. And this to me seems to be one Reason why these Bodies appear always the bigger the nearer they are to the Horizon: For since they appear fainter, they will also appear at a greater Distance, from which they must appear bigger, for the same Reason that Objects appear so in misty Weather.

From all which I think we may safely conclude, that the apparent Colours of Bodies are very useful for us in judging of their Distances, as often as we are otherwise well acquainted with the Intensity and Vigour of their Colour at any other determined Distance. And it is from this Principle, that skilful Painters do upon the same Plane represent Objects at different Distances, by increasing or diminishing the Intenseness of their Colour, according as they would make them appear nearer or further off.

It is indeed true, that the *Pupil*, by its contractile Power, does always proportion itself, as much as possible, to the Vigour and Strength of Light; from which some may think it should be impossible for us to judge of the Distance of Objects from their apparent Colour, or the Force wherewith they act upon our Eyes. But to this it is easy to answer, that the Dilatation and

and Contraction of the *Pupil* is sensible to us, because it depends on the Motion of the *Uvea* that we feel, which Motion proceeds from the different Force wherewith the Light acts upon our Eye, which therefore must always be sensible to us; and therefore, though the *Pupil* should by its Contraction allow no more Light to pass to the *Retina*, when the Object is near than when it is further off, yet we are very sensible of the Intenseness of its Light, because we know that the *Pupil* is then contracted. And besides, when the Pupil is contracted, we see more distinctly than when it is dilated, by which also we are assisted in judging of the Distances of Objects.

The fifth Mean for judging of the Distances of Objects, consists in the different Appearance of their small Parts; when these Parts appear distinct, we judge that the Object is near; but when they appear confused, or when they do not at all appear, we judge that it is at a greater Distance.

For understanding this we must consider, that the Diameters of the Images painted upon the *Retina* are always diminished, according as the Distance of the Objects they represent is increased; and therefore, any Object may be made to vanish, by placing it at such a Distance from our Eyes, as to make its Picture insensible, because of its Smallness; but the smaller the Object be, it will sooner vanish: Hence it is, that all the small Parts of an Object are not seen at every Distance; for the least visible Part will always be smaller or greater, according as the Object itself is nearer or further off. Thus
the

the least Part that is visible at one Foot Distance, will vanish at two Foot Distance; and the least Part that is visible at two Foot Distance, will become invisible at three Foot Distance; and so forth without End. From all which it is manifest, that when the Eye can see distinctly the small Parts of an Object, it must judge that that Object is nearer than any other, whose equal Parts are not at all seen, or only seen confusedly. Painters are well acquainted with this, who therefore, to represent Objects at different Distances upon the same Plane, do always paint them distinct or confused, in proportion as they would make them appear nearer or further off; for when the Picture is confused, its small Parts cannot be distinctly seen; and therefore we judge it at a greater Distance than such as have their Parts more distinctly painted.

The *sixth and last Mean* which we have for the judging of the Distance of Objects, is, that the Eye does not represent to our Mind one Object alone, but at the same time, it makes us also see all those that are placed betwixt us and the principal Object whose Distance we consider; as for Instance, when we look at any distant Object, such as a Steeple, we commonly see at the same time several Fields and Houses betwixt us and it; and therefore, because we judge of the Distance of these Fields and Houses, and at the same time see the Steeple beyond them, we conclude that it is removed to a much greater Distance, and even that it is every Way larger than when it is seen alone, without the Interposition of any other visible Object; and yet it is certain, that the Image thereof.

thereof that is painted upon the *Retina*, is always the same in both Cases, provided that we see it from a Place equally distant; and thus you see how we judge of the Magnitude of Objects from their apparent Distance, and how the Bodies, that we see betwixt us and any Object, assist us in judging of its Distance, just as by the confused Remembrance of all that we have done or suffered, and of all the Thoughts we have had, we are enabled to form a Judgment concerning the Extent of our Duration; or which is the same Thing, of the Magnitude or Extent of Time which has passed since we performed any particular Action: For it is these successive Thoughts and Actions which enable our Mind to judge of the past Time, or the Extent of any Part of our Duration; or rather the confused Remembrance of all these successive Thoughts and Actions, is the same Thing with the Judgment of our Duration, as the confused Sight of Fields and other Objects that are betwixt us and the Steeple, is the same Thing with the Judgment we have of its Distance.

And this affords us another Reason why the Moon appears greater when she rises, than afterwards when she is much elevated above the Horizon; for when she rises, by reason of the Interposition of the Fields, she appears removed to the Distance of several Leagues, *viz.* beyond the sensible Horizon, or that Part of the terraqueous Globe which terminates our Sight; whereas at a greater Height, no Body being interposed betwixt her and us, we don't judge that she is above half a League distant. But seeing Objects do always appear smaller or greater

greater according as we judge them nearer or further off, it follows that the Moon must appear greater when near the Horizon, than afterwards when she is much elevated, by reason of the different Judgments we form of her Distance in those Cases.

There are then *six Means* which serve our Sight for judging of the Distance of Objects, *viz.* Their apparent Magnitude, the Vivacity of their Colour, the Distinction of their smaller Parts, the necessary Conformation of the Eye for seeing distinctly at different Distances, the Direction of their *Axes*, and the Interposition of other Objects betwixt us and the principal Object whose Distance we consider. Of these six Things, which serve to make Objects appear near or far off, there are only the three first that Painters can possibly make use of in their Pictures; whence it is that it is impossible for them perfectly to deceive the Sight. But in the Decoration of Theatres, where all these six Things are artfully conjoin'd, one needs not be surprized if he cannot help being deceived; for in the Scenes, Care is taken to diminish the Magnitude of Objects, in proportion as one would make them appear far off, while at the same time they diminish the Vivacity of their Colour, and likewise paint them confusedly, that the smaller Parts may not be seen distinctly: And thus the three first Means for judging of the Distances of Objects are perfectly satisfied. And for the three last, they represent on different Planes obliquely placed, and a little removed from each other, the Parts of the same Object which they would make appear at different

rent Distances, such as the Pillars of any of the Orders of Architecture, by which Means the two Eyes are obliged to change their Direction for seeing distinctly the different Parts of the Object, whether on the same or different Planes. And this Representation of Objects, or the different Parts of the same Object on inclined Planes, placed at a Distance one behind another, does also occasion that Change in the Conformation of our Eyes, by which we likewise judge of Distances that are within the Limits of *distinct Vision*; and when the Object is beyond the furthest of these Limits, as indeed all the Representations made in the Theatres commonly are, the Degree of Confusion arising from this Position of the Planes, supplies the Place of this Change in the Conformation of the Eye in forwarding the Deceit; so that all the six Means whereby we judge of the Distance of Objects are satisfied, excepting the last, which might a little discover the Cheat, were not Care taken to represent, according to the strictest Rules of Perspective, a Series of Objects lying at different Distances on the inclined and differently removed Planes, of which their Scenes are composed; so that when we view any of these Objects, we cannot help judging them further off than really they are, because we see so many other Objects placed betwixt them and our Eyes. And thus you see how by Art, all the Means whereby we judge of the Distances of Objects may be satisfied, and we thereby deceived: And what contributes yet further to the Perfection of the Cheat, is the false Light where-

wherewith these Decorations are always illuminated.

Having now finished what concerns the Motion of our *Crystalline*, whereby the Eye is adapted to the various Distance of Objects, it may not be improper, before I dismiss this Subject, to explain a little another Motion of the *Crystalline*, which oly obtains in Birds, and is performed by Means of the *Marsupium nigrum*, or *Bourse noire*, as the French call it.

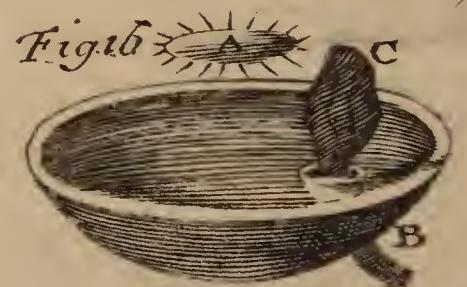
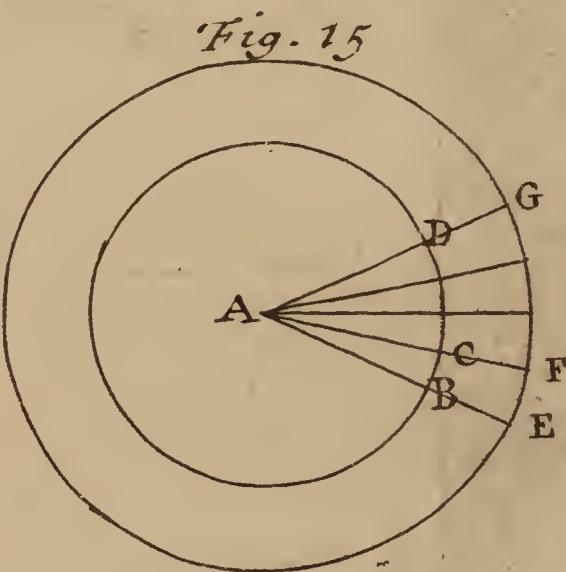
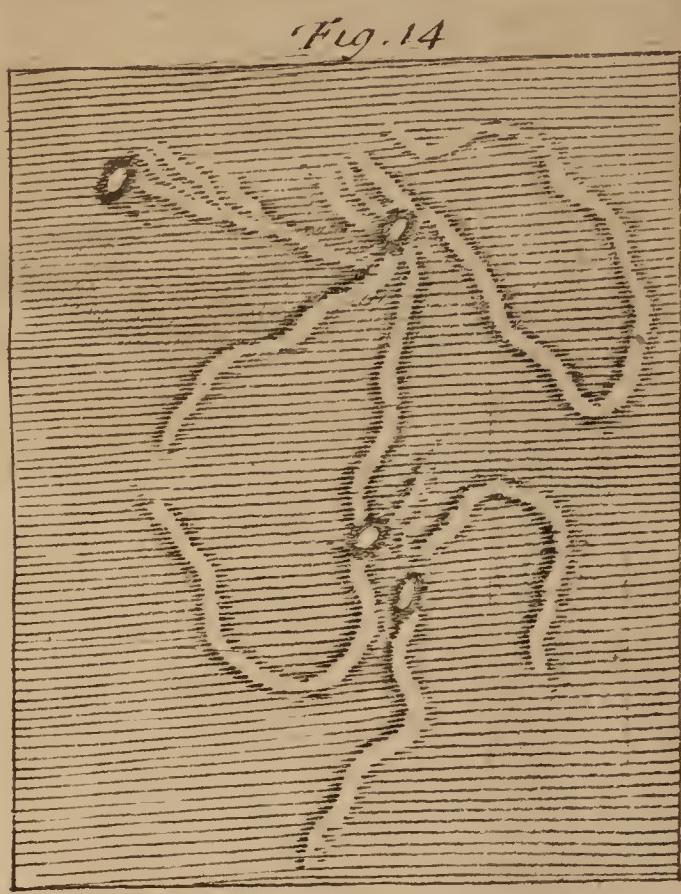
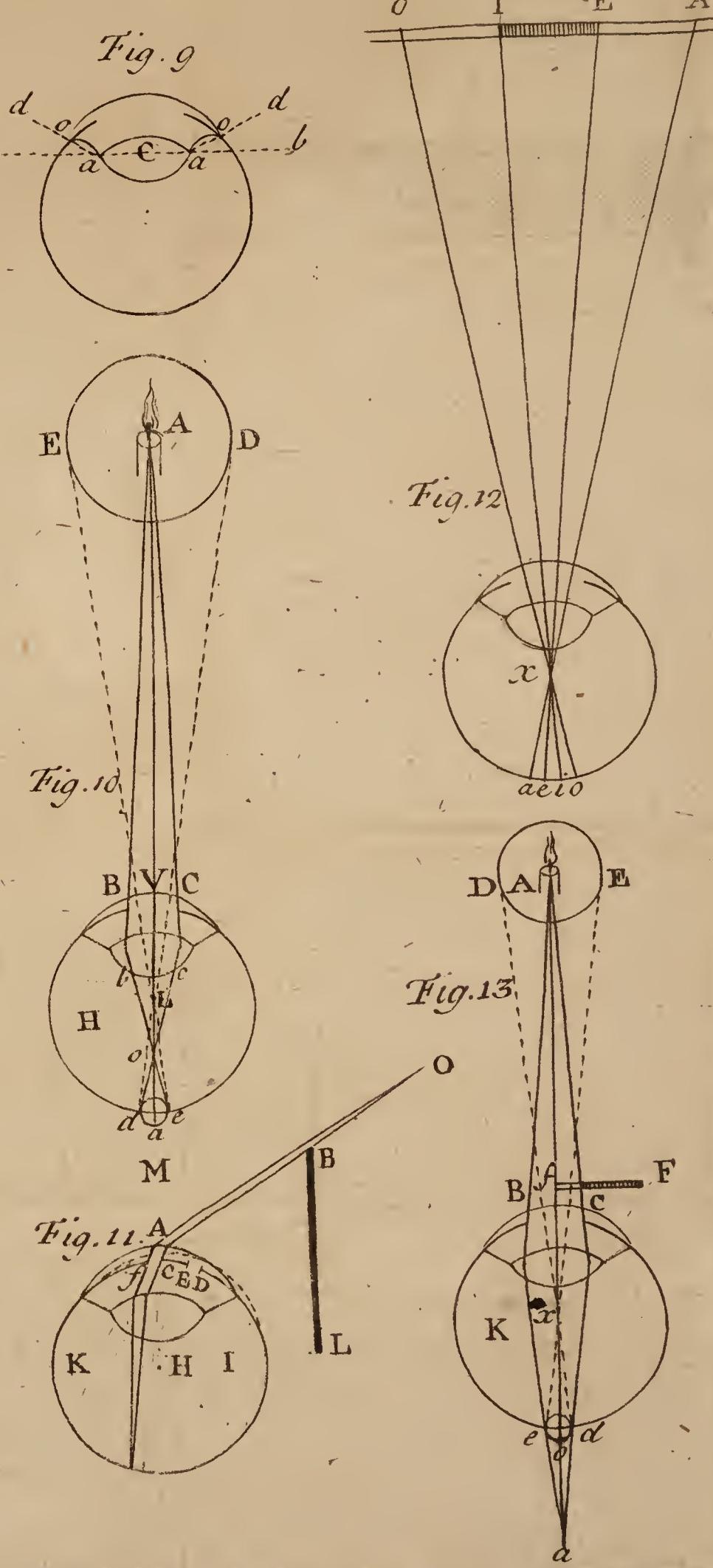
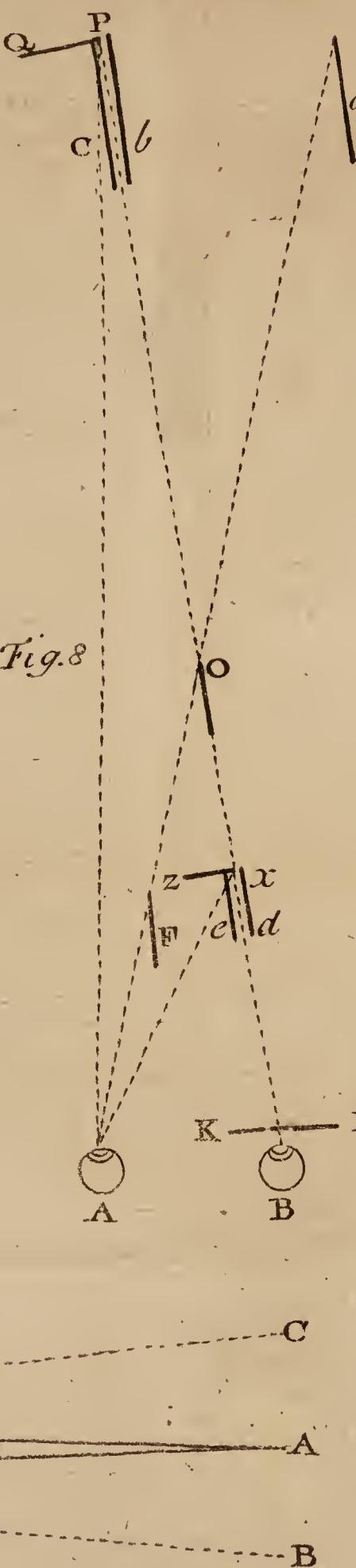
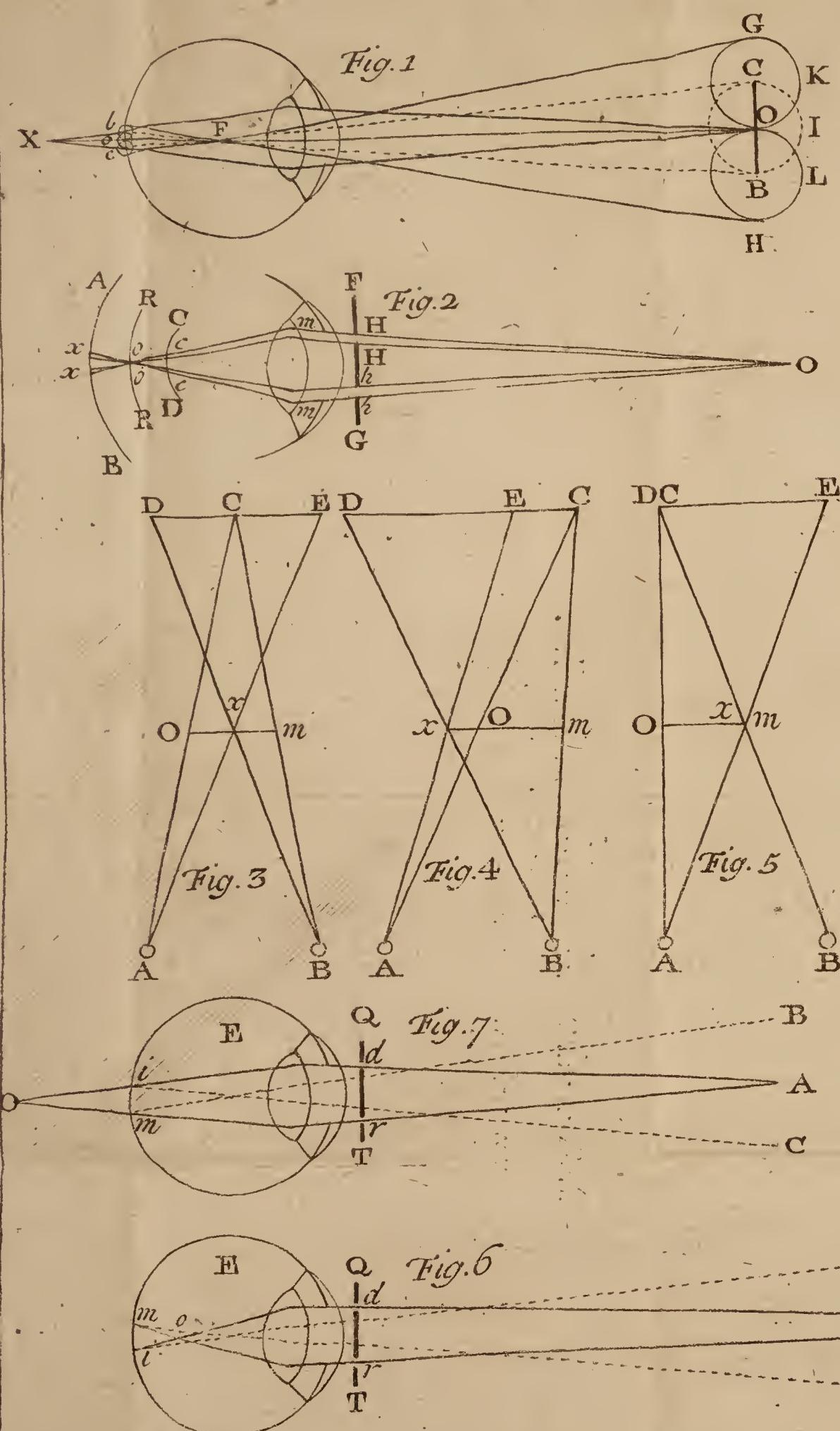
This is a Membrane in Form of a Purse, which arises from the Entry of the optick Nerve, and passes through the *vitrous Humour*, to its Insertion in that Part of the Edge of the *Crystalline* which is next the great *Canthus*. Thus it is described by the French Academists, and by *M. Perrault* in his *Mechanique des animaux*, from whom I have caused it to be copied at Fig. 16. which represents the half of the Globe of an *Ostrich's Eye*, in which A is the *Crystalline Humour*, B the *optick Nerve*, and C the black Purse attached above to the *Crystalline*, and below to the *optick Nerve*. But in some Birds I have found this Membrane of a rhomboidal Figure, agreeable to the Account given of it by Dr. *Petit*, in the *Memoires de l'Academie Royale*, an. 1720.

This Membrane is always covered with a black Pigment, which is of a more intense Colour than that of the *Uvea* or *Choroides*; whence it is that *M. Perrault* and the French Academists conjecture, that its only Use is to assist the *Choroides* and *Uvea* in preparing the Nourishment of the Humours of the Eye, which, by reason of the transparent Purity that is requisite

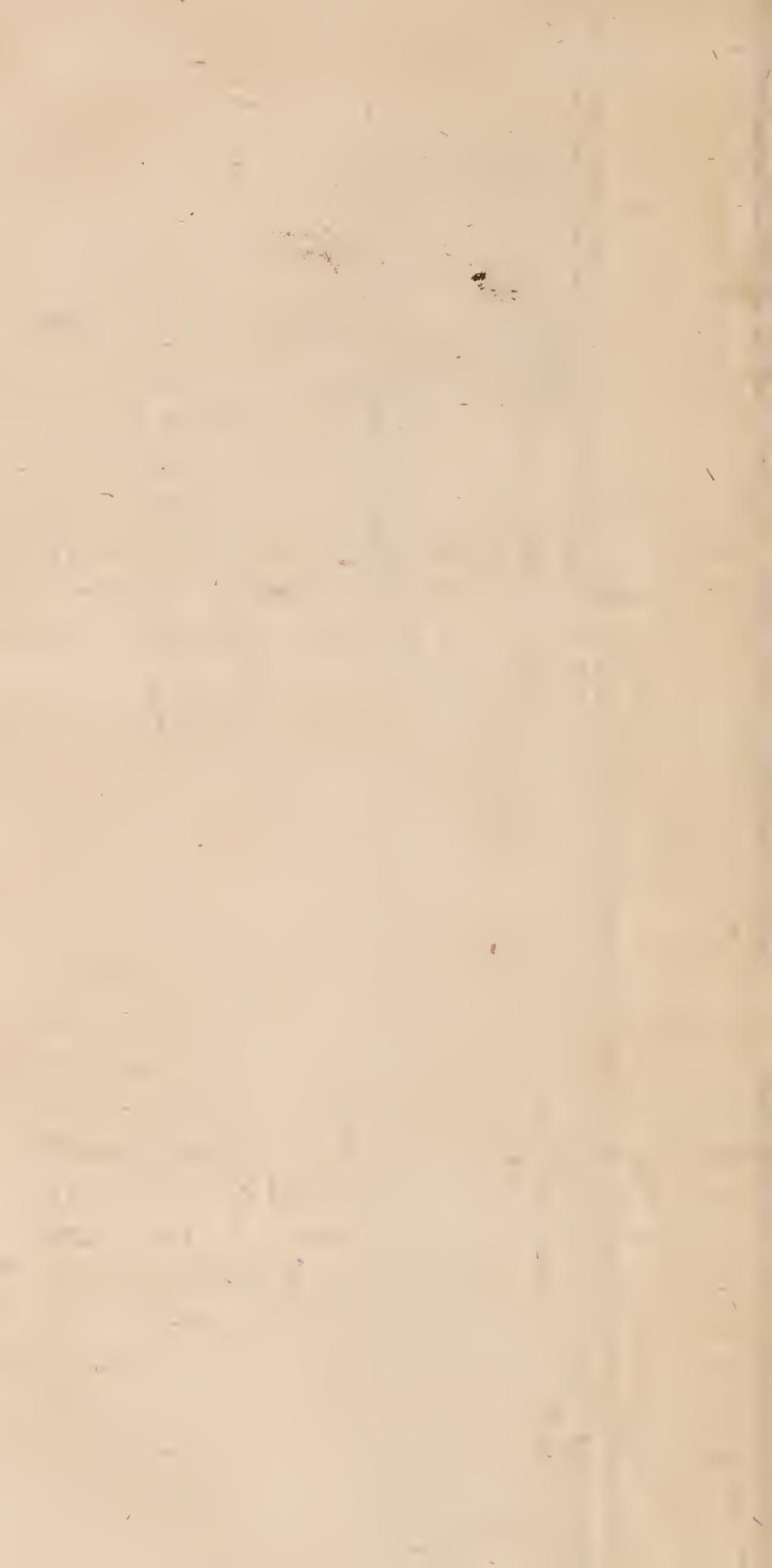
site for them, must have an Aliment very pure and wholly exempt from the gross, earthy and black Parts, by which Bodies are rendred opaque. For these Parts, which may be called the *Lees of the Blood*, are separated therefrom; and retained in the *Choroides* and *Purse* of the optick Nerve, which are fullied and blackened therewith.

I know that the Use of this Blackness in the *Uvea* and *Choroides* is seldom extended to the Preservation of this Transparency in the Humours of the Eye: For the most Part of Authors suppose, that the Blackness of the *Uvea* serves only for rendering this Membrane more opaque, that no Light may enter the Eye but what passes the *Pupil*, and that the Blackness of the *Choroides* has no other Use than to stifle the Rays of Light that fall thereon, and keep them from being reflected back upon the *Retina*; which might efface the Images of Objects, or at least render them more confused and imperfect. But if we consider that the Back-side of the *Choroides*, next the *Sclerotica*, is likewise covered with this black Pigment; and that in all Animals, even those which have its concave Side next the *Retina* of another Colour, as *Aquapendente* in his Treatise *de oculo*, § 1. cap. iv. observes, we cannot but think that it likewise contributes to the Preservation of that Transparency in the Humours, which is absolutely necessary for the Transmission of Light; and that because there appears no other Reason for the black Colour upon the Back-part of the *Choroides*: Thus the *Lion*, *Camel*, *Bear*, *Ox*, *Deer*, *Sheep*, *Dog*, *Cat*, and many other Quadruped-

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R. Cooper Sculp.



drupeds, and even some of the Bird-kind that are not endowed with a good Sight, such as the *Owl*, and other nocturnal Birds, which have the Inside of the *Choroides* of a blue, green, yellow, pearl, or other bright and resplendent Colour, are never found to want a considerable Quantity of this black mucous Pigment upon the convex or Back-side of this Membrane, which can serve for nothing else but for rendering the Aliment which goes to the *Crystalline* and other *Humours* of the Eye more pure and free from the gross black Parts, which might render them opaque and unfit for transmitting the Light.

It therefore seems necessary that this Tunicle should be provided with Glands proper for secerning this black Mucus, that the *Cornea* and *Humours of the Eye* may not be tinged with any Opacity: For as in the Jaundice the whole Body becomes yellow, by reason of the Bile which is not duly secerned in the Liver; so it is not to be doubted but the *Cornea* and *Humours of the Eye* would soon lose of their Transparency, were it not for the secretory Power of the *Uvea* and *Choroides*, by which the Blood which goes to their Nourishment is free'd of its most opaque and black Parts: Whence it is that Animals, whose Blood abounds most with blackish Particles, have this Membrane proportionally of a more intense black Colour; for it is observable that those who have most Blackness in their Hair or Feathers, have this Membrane also most black.

There is a Mechanism not unlike this, very remarkable in the *Sepia* or *Cuttle-fish*, which

is known in the Apothecary Shops from a Kind of Shell commonly called *Os Sepiae*, wherewith its Back is covered: This Animal is provided with a Bag towards the Throat, near the Stomach, whose Use is to separate and contain all the opaque black Particles of its Blood and Humours; hence it is that the Substance of this Fish is of a white Colour, which otherwise probably would have been black: For the Humour contained in this Bag is so very black, that it exceeds that of Ink itself, and one Gut thereof is sufficient to blacken many Basins of Water. Whence it is that this Fish does easily save itself from Fishers and other Fish that seek to devour it, by expressing a little of this Liquor into the Water in which it swims; and therefore *Plutarch* very agreeably says, that this Fish imitates what *Homer* makes the Gods do, to hide and deliver their Friends from the Danger to which they are exposed in Battle, which is to cover them with a dark Cloud, that they may escape safe. Now as the Substance of this Fish becomes white, from the Separation of all the opaque black Particles contained in its Blood and Humours; so it is more than probable that the *Cornea* and *Humours* of the Eye retain their Transparency; because the Blood which goes to their Nourishment is, by the secretory Power of the *Choroides* and *Uvea*, free'd of all these opaque black Particles which could in the least tarnish them, or diminish their pure Transparency. And this may possibly be one Reason why those Creatures that see best, such as *Eagles* and other Birds of Prey, have the *Pupil* very black; and on the contrary, the *Owl*, *Lion*, and

and other Animals whose Sight is not so good, have this Hole less black; because the Bottom of their Eyes is not covered with this black Pigment.

Thus much being premised concerning the Use of the *Choroides* and *Uvea*, it will not be questioned but the *Bourse noire* has a similar Office, and that it serves to assist them in the Separation and Reception of all those opaque black Parts of the Blood which might have fulfilled the Humours of the Eye; and that for these Reasons, *imo*, Because this Membrane is never found in any Creature but Birds, and that because of all other Creatures they have Occasion for the best Sight, by reason their Flight places them at a considerable Distance from Objects which they ought to see. *2do*, Because as Birds naturally fly more high, and by that Means require a more piercing Sight, this Part is always proportionally of a more intense black Colour: Thus in *Eagles*, and other Birds of Prey, it is always covered with more of this black Mucus than in our domestick Birds, which either do not fly, or do not fly so high, such as *Geese*, *Hens*, &c. *3to*, Because in the *Demoiselle of Numidia*, that strange dancing or buffoon Bird, which is the celebrated and wonderful *Otus* of the Antients, and which, by reason of certain Ways of acting, wherein it seems to imitate the Gestures of a Woman who affects a Grace in walking and dancing, has of old by *Aristotle* been named *Actor* or *Comedian*; I say, this Bird, which is the only one wherein the *French Academists* found this *black Purse* wanting, the *Choroides* is a great deal blacker and thicker

than ordinary, as if the whole Dregs of the Blood, which in the Eyes of other Birds should be retained in the *Choroides* and *black Purse*, had here been collected into the *Choroides* alone.

These are Reasons that determine us to agree with *Monsf. Perrault* and the *French Academists*, in thinking that the Use of this Part is to preserve that Transparency in the *Humours* of the Eye so necessary for Vision, though at the same time we are of Opinion that it has yet another Use no less considerable, which I shall now explain.

Every Body knows that in Birds their Eyes are not as in Man, Dogs, and such other Creatures as look the same Way with both Eyes placed in the Fore-part of their Head, but so much towards the Sides thereof, as makes it impossible for them to direct both of them to the same Object. Neither does this Situation of their Eyes ever allow them to be turned towards an Object placed straight before them : Hence it is you shall frequently observe, that when any Bird wants to see an Object that is straight before it, it does turn the Side of its Head that Way, that the Rays of Light may fall directly upon its Eye ; but then their Sight must, in some Measure, be weaker, because the Object is only seen with one Eye. Now this being understood, it is easy to see that, without this *Marsupium nigrum*, it would have been impossible for Birds to see their Food wherewith they are nourished ; because the Rays of Light that come from an Object placed near the Extremity of their Bill, would, in falling

falling obliquely upon their Eyes, have rendered their Sight prodigiously confused and imperfect; just as the Image of a Candle, or other Object, is confused, when made by a *Lens* placed obliquely, for the Picture cast on the Paper is always more and more confused, in proportion to the oblique Situation of the *Lens* through which the Light passes; and therefore, to prevent this Defect in the Sight of Birds, Nature has very wisely provided them with this Part, which being of a muscular Substance, does, by its Contraction, draw that Edge of the *Crystalline* next the *great Canthus*, towards the Bottom of the Eye, and render its Situation such, as the Rays of Light which come from Objects placed directly before them, and towards the Extremity of their Bill, may fall upon it more perpendicularly, which was absolutely necessary for distinct Vision. This is an admirable and truly elegant, and surprizingly beautiful Piece of Mechanism for perfecting the Sight of those Animals, that cannot turn their Eyes to Objects straight before them; and to confirm this Opinion, it may be worth while to observe, that this *Bourse noire*, as the French call it, though it be tinged black, like the *Choroides*; yet if it be wash'd, it appears to be composed of muscular Fibres, not unlike the *Ligamentum ciliare*. Nor is it any solid Objection to this, supposing that this Membrane should not always be found inserted into the *Crystalline*; for it being so firmly fixed unto, or embodied in the *vitrous Humour*, that the *vitrous Humour* hangs firmly to it, and is not so easily parted from it, all the Motions of this Mem-

Membrane are easily communicated to the *vitreous* Humour, and by consequence to the *Cristalline* which is connected to it.

I should now proceed to the Motions of the *Uvea*, whereby the *Pupil* is contracted and dilated, which is indeed by far the most beautiful and entertaining, as well as the most useful of all the Motions that belong to our Eyes: But the Humour of scribbling will hold out no longer; and it is well that it is so, for I find this Paper has already swelled much beyond its intended Bulk, for which, as well as for several Defects and Imperfections, and possibly some Mistakes, which could not be so easily avoided, considering the Hurry in which it has been written, I should now make an Apology. But as a tedious Apology for a tedious Performance would be insufferable, I shall add nothing further.

XV. A Wound with a hot Iron penetrating the Pelvis; by Dr. ANDREW WILLISON Physician at Dundee.

THE Regard Physicians and Surgeons have for their own Character and Reputation, makes them often shy to undertake the Cure of Patients, where they have no Hope of Success, and may be blamed by the Ignorant, if the Disease is fatal; nay the Despair of doing good is sometimes a Reason of proper Remedies being neglected as needless. But as every one can save himself from Reproach, by making a due Prognostick of the Event to the Relations, and People have recovered beyond Expectation,

præstat

præstat anceps quam nullum tentare remedium,
the Sick should have all the Assistance which
the healing Art can give.

By this general Reflexion I would introduce
the History of a Case, which contains indeed no
new Method of Cure, but where Nature, with
a little Assistance, made a Cure of a Disease
which I look'd on as desperate.

In the Beginning of *March 1735*, a Smith
pushed a red-hot Iron with such Force into the
Buttock, an Inch and a half from the *Anus*, of
a young Man of twenty Years of Age, that the
Point of it came out through the *Linea alba*, a-
bout an Inch above the *Offa Pubis*, having
pierced through the *Pelvis*. After some Hours
I saw him. His Pulse was low and intermitting.
He had violent bilous vomiting from time to
time, great Pains in his Belly, Thirst, Watch-
ings, cold Sweats and Faintings, with scarce
any Blood from the Orifices of the Wound.

I ordered fourteen Ounces of Blood to be let
from him, and to inject an emollient Clyster
with Turpentine, which operated well, and he
was somewhat relieved of the Pain in his Belly.
He rested ill all Night; and, next Morning,
his Symptoms continued, and he had passed no
Urine now twenty Hours after receiving the
Wound, notwithstanding his having drank
great Quantities of Liquor. His Pulse was more
frequent and harder. I caused twelve Ounces
of Blood to be taken, and after fomenting his
Belly well with Emollients, rubbed it with *Ol.*
Scorpionum. By which the Pain became much
less. Thirty Hours after receiving the Wound
he voided a little Urine with much *Mucus*, such
as

as People with Stones in their Bladder commonly pass. At Night the Clyster was repeated, and brought off a great deal of ropy Slime with it. An Emulsion with some Nitre was given for ordinary Drink, and a cordial Julep did him much Service in moderating the vomiting.

The third Day he again used the Fomentation, Clyster and Emulsion. His Urine and Excrements came now plentifully by the lower Wound near the *Anus*, little being evacuated the natural Way, except a little slimy Urine which he passed with sharp Pain. I ordered diluted *Digestive* and *Mel-Rose* warmed, to be injected into the Wound.

The bad Symptoms continued ten Days, and the same Medicines were used. After this Time his Urine came the natural Way. In ten Days more the Excrements did the same, and in six Weeks he was cured, having taken a low vegetable Diet all the Time, with thin weak Liquors for Drink, and Opiats at Night.

Towards the End of the Cure he was emaciated, and had a Cough, but recovered of both by a Milk Diet.

XVI. *A Stone in the Bladder formed on a Needle; by Mr. ANDREW BROWN Surgeon in Dalkeith.*

A Gentleman's Daughter in this Place began, at two Years of Age, to be afflicted with Colick Pains and Difficulty of making Water, which were commonly removed by Clysters, Purgatives, Diureticks, and some other Medicines. When three Years of Age, her Disease had

had more the Appearance of *Gravel*, for the Severe Pains were about the *Regio Pubis*; she had partial Obstructions of Urine and frequent Vomiting, but never complained of her Back. These Symptoms not yielding to her former Medicines, I put her into the *Semicupium*, which, with Injections, relieved her. She was so sensible of the Benefit of the *Semicupium*, that she frequently desired it, and sometimes came unwillingly out of it.

Her Pains and Obstruction of Urine increased the following Year, the warm Bath being the only Medicine that gave her Relief, for in only she made Urine freely; at other Times either came away insensibly, or in very small Quantity at once.

In the End of *February 1735*, when she was four Years and two Weeks old, she complained of a great Pain in the *Pudenda*, putting her Fingers there as if she would extract somewhat. All the external Parts swelled greatly, and inflamed. Her Mother then sent for me. Upon pressing the right *Labium*, I felt like a Fluctuation of Liquor in it, and on the posterior Part of the *Rima* there was some Pus. I fomented the Parts with warm Milk, and applied an emollient Poultice upon them.

Next Day the Quantity of Pus was greater, and she was easier, but still aimed at extracting what pain'd her. The same Applications were continued.

On the second Day her Mother observed a white hard Substance in the Passage, and the Child was miserably tortured with Pain. In the Evening, while a Fomentation was applying

ing, the Stone, which you will receive with this, fell into the Bason. It weighed then more than half an Ounce, and is, you see, grown round a Needle, the Ends of which stand out.. See *Tab. III. Fig. 1.* where it is represented of the natural Size with the Ends of the Needles A and B standing out.

The Child was too young to give any Account of what had happened to her so long before; and the Parents knew of no Needle she had swallowed, or of any Pains she had had,, till the Colick Pains, which I mentioned in the Beginning of this History.

When this Stone came away there was neither Blood nor Pus with it, nor had she passed any Blood before. Since that Time she has still complained of Gravel Pains, and the U-rine flowing involuntarily excoriates the Skin..

XVII. *An Aneurism*; by ALEXANDER MONRO, Professor of Anatomy in the University of E- dinburgh, and F. R. S.

TH E Cases of *Aneurisms* cured by Operation are so few in Books, that I perswade myself you will not refuse a Place in your *Collections* to a second, especially that it serves to confirm a general Doctrine which you have already published. (See *Art. 15, 16 and 17 off Vol. II.*) And that some Improvement on the Operation is likewise to be propos'd along with the History.

Andrew Rady, living in *Galloway*, had the Misfortune, in being bled in the basilick Vein of the right Arm, by some Gardner there, to have

have his Artery hurt, which was followed by an *Aneurism*. Some more than a Year after, he came to Town here, and was received into the *Infirmary* in May 1735. On the 22d Day of that Month Mr. *George Cunningham*, the Surgeon then in Attendance, performed the Operation. After the *Tourniquet* was applied, Mr. *Cunningham* laid open the Tumor from one End to the other, with one longitudinal Incision; then taking out the polypous Substance, and a small Quantity of liquid Blood, the small Aperture of the Artery was so plainly seen, that I put a Probe into it, and raised the Trunk of the Artery, while he passed the Needle behind it, the Sides of the Wound being held asunder in the mean Time by two blunt Hooks. The proper Membrane of the Tumor was considerably thicker and stronger than in *James Forest's Aneurism*, and required Force to push the blunt *Aneurism-needle* through it, but the Nerve was pressed by the Tumor a good way from the Trunk of the Artery, so that there was no Danger of taking the Nerve within the Ligature. After making the superior Ligature, the *Tourniquet* was untwisted, but no Blood came by the Orifice, which shewed the anastomosing Canals to be very small; the second Ligature was however made below the Orifice for Security. The Cavity was filled with soft Lint, and the other ordinary Dressings applied. That Afternoon his Hand swelled and became warm, which removed all our Fears of the Circulation being intirely stopped. No Pulse was to be felt on either Side of the Wrist for several Days; but before the 5th of June, when

both the Ligatures suppulated off, the Pulse was plainly to be felt on both Sides of the Wrist, and he cured soon, having as much Strength and Motion in that whole Member as ever.

To make this Operation more speedy and safe, I would propose, that as soon as the longitudinal Incision is made, and the *Polypus* with the Blood is removed, the Patient's Elbow being bended some Way, the Operator should take hold of the humeral Artery with the Thumb and Fore-finger of the left Hand, and gripping it towards the back Part, should push the Needle close upon his own Nails, by which he has a sure Direction whereby he may shun the Nerve, which he can readily distinguish from the Artery by feeling, and can in that Posture of the Arm easily draw the Artery so far outwards as to keep free of the Nerve.

The Operation then of the *Aneurism*, which appeared by the Description Surgeons gave of it, to be very nice, difficult, tedious and precarious, may be done easily, quickly and safely, by opening the whole Tumor at once, and then putting the Ligature about the Artery as just now described.

XVIII. *A white Swelling of the Knee; by the same.*

Many Instances are daily seen of that tormenting, dangerous Disease, the *white Swelling of the Joints*; but before one has an Opportunity of examining them by Dissection, to understand the Nature of the Disease right, the Matter has become so sharp that it erodes

the

the Bones themselves, and then one sees the same Thing as he would do in a *Spina ventosa*. I met with one Patient in our Infirmary, whose Joint of the Knee was just as far advanced as I wished to examine, when it was amputated. It gave me a better Idea of that Disease than I had before, and possibly may do so to some of your Readers, which induces me to send it to you.

Isabel Blackadder, a young Woman of a delicate tender Constitution, having hurt her left Leg by a Fall some Years ago, an Ulcer broke out near her Heel, and several Pieces of Bone cast out at it; but it recovered so well, that she went to Service again.

In the End of 1734, having hurt the same Leg by another Fall, the Knee swelled, became very painful and stiff, for which she was taken into the Infirmary; where, after Bleeding, a few Doses of *Aquila alba*, and Embrocation with *Aq. mindereri*, the Swelling and Pain both seemed to abate, but soon became as bad as formerly, and never afterwards yielded to any Medicines.

The Skin of the swelled Parts was not discoloured, and on the Inside of the Joint a Fluctuation was felt in one or two Points, but the Quantity of Liquor appeared very small, and the Fluctuation had a different Feeling to what commonly *Pus* collected in a Cavity has. Her Pains were very sharp, especially upon the least Motion of the affected Leg, her Flesh and Strength decayed daily, and the hectic Symptoms increased; which at last brought her so low, that she could not be raised to a sitting Posture without fainting, which brought her under the Nec-

cessity of suffering the Member to be amputated.

In this Condition she was when the Member was cut off above the Knee by Mr. *Douglas*, after which she recovered daily, and walks on a wooden Leg of the same Form which *Alexander Sheppard* used, whose Case I shall soon extract also from the Records of the Infirmary to send you. (See Art. XXI.)

When the diseased Joint was dissected, all the cellular Membranes, in which Fat is naturally contained under the Skin, between the Muscles and Tendons, and upon the Ligaments, were found full of a glairy Matter, which had insinuated itself so much every where, and had made the other Parts so soft, that we could scarce distinguish one from another. In several Places of this glairy Substance there were small Cavities full of *Pus*. When the Articulation of the Knee was opened, all the mucous Glands and fatty Membranes were seen in the same Condition with the exterior Parts ; the *semilunar Cartilages* themselves between the *Tibia* and *Femur* being quite soft, and with the same cellular mucous Appearance that the Glands had. We also observed some *Pus* within the Cavity of the Joint, but the Extremities of the Bones were scarce begun to be eroded.

XIX. Part of the Cartilage of the Joint of the Knee separated and ossified; by the same.

IN the Letter inclosed in this Paper, you have an Account of a *white Swelling* from a very uncommon Cause, treated by my good Friend Dr. *Sims* Professor of Medicine in the University

sity of St. Andrew's. (See the following Article.) In it the Doctor does not, and indeed could not, determine how the loose Bone he describes came into the Cavity of the Articulation. I believe it may not be disagreeable to you to relate what I saw once in the Joint of the Knee, very like to the Bone he took out, and which may serve to explain that Phænomenon.

In the Body of a Woman aged forty, which I dissected in February 1726, I found, within the Ligament of the Articulation of the right Knee, a Bone of the Shape and Size of a small Turkey Bean, depending by a Ligament half an Inch long from the external Side of the *Tibia*. The Bone, when cut, had only a thin external firm Plate, being composed within of Cells which were full of Oil. On separating the *Femur* and *Tibia*, I saw the Ligament came out from the exterior Edge of the Cartilage covering the exterior Cavity of the *Tibia*; and more internally a Part of the Cartilage of the *Tibia*, of the same Shape with the Bone, was wanting. In Tab. III. Fig. 2. A is the Bone hanging by its Ligament, and B is the Bone cut open. The Circumstances of this Malefactor made it impossible for me to know exactly her Symptoms or Complaints before her Execution.

X. 3

XX. An

XX. An uncommon Tumor of the Knee, with
Remarks on the white Swellings of the Joints ;
in a Letter to Mr. MONRO Professor of Ana-
tomy, from Dr. THOMAS SIMSON Professor
of Medicine in the University of St. Andrews..

S I R,

THE Glory of Medicine consisting in the Cure of Diseases, every Discovery that contributes to make this more certain, must be looked upon as of moment in that Art. Upon which Account, I look upon the History of the particular *Species* and *Individuals* of Diseases, as a Part of our Art that can never be fully enough enlarged upon: For if it be in Diseases as it is in Botany, that frequently the *Species*, nay the *Individual*, has such particular Properties as to satisfy us that they have a most peculiar Nature of their own, however much besides they have in common with others, we cannot be sure till a Trial satisfies us, whether or not this peculiar Nature will require a particular Consideration in the Cure, and consequently should be animadverted to, to make our Method the more certain and extensive. It is this Consideration, Sir, which makes me lay before you an Instance of what is called by our English Writers, the *white Swelling* at the Joints, which arose from a most singular Cause:

A Countryman in the Neighbourhood of St. Andrews had for several Months an Uneasiness in walking, from a Pain in his left Knee, which had got no observable Injury: When the Pain was greatest, he found something of a hard

hard Body immediately under the *Rotula*, generally at the Inside of the Leg, though sometimes at the opposite, and could get no Ease, till by chaffing it upwards with his Hand he made it disappear; the Parts about were tumified, as we find in the Case of a *white Swelling* at this Joint, though to no great Height: The hard Body always made its Appearance upon walking; so that when I came to see him, he was obliged to take some Turns through the House, before he could make me sensible of it. I easily catched it betwixt my Thumb and Finger, where it felt so distinctly, that I could not suppose but it had its Seat in the *Tunica Adipofa*, immediately under the Skin, which made me immediately pull out a Bistort to open into it; but my Patient, not having Resolution to allow me, did plead some Days Delay to think upon it. After which, he came to my House with some of his Friends, and acquainted me that he would submit to the Operation, he being perpetually upon the Rack, by the falling down, as he called it, of that Body, which happened every Moment of the Day he offered to stir. It appeared so loose and superficial, that I had no manner of Doubt of Success, and so with a Scalpel immediately began to make an Incision upon the Body, which in the mean time I held betwixt my Finger and Thumb: But to my great Surprize, when I had made my first Incision through the Skin and Fat, I found a membranous strong Bag between me and the Tumor, which made me sensible for the first Time where this floating Body was lodged; however, though now I reckoned the Operation

Operation of more Importance than formerly, I was satisfied nothing else could help my Patient than to continue the Incision, which I did, and upon entring the Bag, there was at least four Ounces of the *Synovia*, or a thick pellucid Humour issued out with the hard Body, which I found much of the Shape, though larger than a Kidney Bean; it then appeared wholly cartilaginous, and very smooth and protuberant. But, upon drying, it shrank in and shewed itself a Bone covered over with Cartilage. In cutting thro' the Bag, which was firm and thick, the Patient expressed the utmost Pain, which turned easier upon taking out the Body, and after the Evacuation. I earnestly desired the Patient to stay in the Town that Night, that I might have the better Access to attend him; but nothing would perswade him. So that, after some Hours Stay, he mounted Horse, and rode under Night two Miles to the Country, in time of a most keen Frost, which raised the Pain of his Knee to the greatest Height, and obliged him to send express for me at Midnight. I ordered it to be fomented with the most anodyne softning Materials I could contrive, but with little Success; his Knee swelled exceedingly all round: And what was observable, he did not make so much Complaint of the Place where the Incision was made, as at the opposite Side. He was bled and purged with *Calomel* frequently, but all to no Purpose, being notwithstanding all that could be done to him for a Month's Time, seldom free of horrid Cries and Complaints; nor could he allow his Leg to be moved in the most gentle Way we could contrive, and

and never slept but when he took Opiates. Bladders of Water round his Leg, as warm as he could bear, had little Influence, but Water syringed took more Effect, which I made two Men do by Turns for near an Hour at once, from a large Clyster Syringe; but though this caused the Pain and Swelling to abate, yet it did not carry it quite off till I applied a *Caustic* to the Outside of the Knee, which being kept running, and the Syringing continued, it gradually wore off in about a Year's Time: So that he is quite free of all Complaint and Swelling, and walks about without any Impediment.

Amongst the many Causes of this Swelling about the Knee, I have not met in any Author such an one as this loose Body within the Bag which environs the Joint; I must leave it to my Readers to suppose whence it had its Rise: Only I must give my Opinion, that it was the Irritation of this loose Body which had produced such a Quantity of *Synovia*, by which the Bag was made to stretch and become so contiguous to the Skin, and allowed its Guest such an easy Motion from Side to Side, tho' it appeared most at the Inside, which is the most depending. But I would have it observed what an obstinate Swelling the Irritation caused by the Wound, the hanging it in riding, and the Cold of the Night had produced, so that it stood out a very long Time against the most efficacious Remedies, as all these Swellings about the Knee, or about any other Joint, do for most part. I have had several of them of a shorter standing with the worst Symptoms, such as a considerable Swelling round the Joint, while a few

Places

Places seemed to be rising by themselves, forming, as one would have reckoned at first Look, an Abscess; which with Purging and the Fall of cold Water, according to *Cheyne's* Method, I have in a few Weeks carried off. To some I applied with like Success the Fall of warm Water, according to *Le Dran's* Method. To others I applied sometimes the cold and sometimes the warm Water by Turns with like Success. In those of longer standing, though I never saw any of them carried off quite, yet I always found they got Relief from the extravagant Pain, against whose Return they can never be secure, by the same Methods. Several of those I have had under these Cases could give no Account of the Rise of the Trouble. Some Women have contracted it under the Diary Fever (*the Weed*) they are subject to in Child-bed. A great many get it by Wounds or Bruises about the Parts, which are capable of the easiest Irritation, and never miss to bring all the neighbouring Parts to suffer; and it seldom misses that the *Flexor-Tendons* turn rigid under the Disease: the Patient generally, for Ease, keeping the Parts about the Joint in as relaxed a State as possible; and thus the *Flexor-Tendons*, which share the Pain and Irritation, turn rigid and stiff: Wherefore, I would rather look upon this as an Effect of such a Disease than the Cause, as I find *M. Maloet* does in the Mémoirs of the *French Academy of Sciences* for the Year 1728.

As I have been Witness to the greatest Mischiefs from such a Disease, I thought it just to observe, that it should be plied very earnestly upon

upon its first Appearance; and that the Improvers of our Art should lay themselves out to see if they could fall upon a more certain and expeditious Method of Cure. I am,

Your most humble Servant,

St. Andrews, July
21, 1736.

THOMAS SIMSON.

XXI. *The History of an Ulcer of the Leg;* by
ALEXANDER MONRO Professor of Anatomy
in the University of Edinburgh.

Alexander Sheppard a Smith, aged thirty six Years, having accidentally wounded the fore-part of his Leg with the Point of a Hook about the Beginning of Harvest 1732, an Inflammation and Suppuration were brought on this Member, and were neglected till October, when he was received into the Infirmary here.

In examining the State of this diseased Leg, a Sinous Ulcer was discovered to extend itself the whole Length of the Leg. This being laid open, sent out only a very small Quantity of sanious *Ichor*, and in a few Days after, the Knee was attacked with a painful Swelling, which soon yielded to a Fomentation of Urine, in which *Wormwood*, *Camomel* and *Mallows* had been boiled. The Ulcer seemed to be in a good Way for some Days after this; but then proud spongy Flesh rose from it, which was kept down by sprinkling red *præcipitate* upon it; and, in order to correct his bad Habit

bit of Body, he was ordered to drink plentifully the Decoction of *Guajac*, and had repeated Doses of mercurial Purges given him. These Medicines had a good Effect for some Time, but upon interrupting the Use of them a little, the Matter of the Ulcer turned more sanguous, he felt a Pain and Stiffness in his Knee, Pimples broke out all round the Ulcer of his Leg, and the Itch appeared every where else on his Skin. The mercurial Purgatives were therefore repeated, and again brought the Leg to a better Condition, but left a Diarrhœa that continued several Days.

In the Beginning of *January* 1733, he was seized with a feverish Paroxysm like that of an Ague, and next Day a red Swelling of the Erysipelatous kind was observed on the back Part of the diseased Leg near the Ankle.

The Day following the Tumor of the Leg was less, but his Knee was considerably swelled, though without any Heat or Redness, his Pulse was frequent, with Thirst, Heat, and other feverish Symptoms. A low vegetable Diet was prescribed, with Emulsion or Milk and Water for his Drink, and emollient Fomentations and Cataplasms were applied to his Knee. Notwithstanding which the feverish Symptoms continued, the Knee swelled more, and became more painful, and a large Suppuration began in the back Part of his Leg. These were soon followed by an obstinate Diarrhœa; so that before the End of this Month *January*, he was emaciated to Skin and Bone, was so weak as scarce to be able to turn himself in his Bed, his Appetite was quite lost, and he had constantly

a quick

a quick Pulse and Thirst, with Night Sweats, and a colliquative Diarrhoea. His Knee was greatly swelled, with its Ligaments so weak that the Bones could be made to have the Appearance of a partial Luxation, and a certain Grating was felt on moving the *Patella* from one Side to the other; at the same time a large Collection of *Pus* was made in the Back-part of the Leg.

He had refused to allow the Amputation of his Leg to be made when it was first proposed to him, but finding himself worse every Day, and being convinced that the only Chance he had for Life, was to have that Operation performed, he allowed it to be done on the first Day of February by Mr. *Hope*, who was the Surgeon then attending.

The Member was taken off four Inches above the Knee. When this Joint was dissected, the Cartilages were found eroded, and the Bones were become carious.

From the Day of the Opération he had no more Diarrhoea; and in twelve Days after, all the other hectic Symptoms were gone, his Flesh and Strength being evidently recovered considerably.

The Cure went successfully on all the Months of February and March, except that on March 16th, a livid-coloured Spot, about the Size of a Sixpence, was observed towards the posterior Part of the Wound, which having a Pledgit dipt in Brandy applied to it, could not be seen next Dressing.

April 6th, Several *Granula* of Flesh that came out, with very small Peduncles, from the solid

Substance of the Bone, threw out a considerable Quantity of Blood, and four or five more such Hæmorrhagies, from these fleshy *Papillæ*, happened in this Month, and were always stopped by applying Oil of Turpentine.

April 12th, A large livid *Fungus* sprouted out from the Cavity of the Bone, and several other such *Fungi* were seen on the fleshy Parts also of the Wound. These were removed by repeated Searing with a red-hot Iron, and the Application of Oil of Turpentine.

In the Beginning of *May* he was altogether free from the *Fungi* and Hæmorrhagies, and *May* 15th, a Piece of the Thigh-bone, about the Thickness of a Crown, exfoliated.

He was then cured of his Itch; appeared to be every Way in good Health and Vigour, with the Bone covered, and all the Wound cicatrized, except about the Breadth of half a Crown in the middlemost prominent Part where the Bone was, on which a Skin could not be brought; and therefore it was necessary to contrive such an Instrument for him to walk with, as would not allow the Weight of his Body to bear on this raw Part, and that could make the soft Parts to support the Body, without resting on the Bone.

The Instrument he made use of with Success was of the Form which you see represented in the annexed Figure, (See *Tab. III. Fig. 3 and 4.*) which I chuse to send you, because if such an one is described by any Author, his Works are not very generally read in this Country.

A is a Box of Wood made firm on the Outside by two Rings of Iron *a, a*, and covered within

within with a thick Twilting of Wool under Chamois-Leather.

B is the Stick or Leg, of such a Length as answers to the sound Extremity.

A Piece of strong Bend-Leather, shaped as in *Fig. 4.* is fixed to the Brim of the Box A, the two Ends CC being at a Distance from each other, and having Py-holes for passing the Lace D through; the middle long Part E has a large Piece of thick Chamois, or thin well dressed Buff-Leather F fixed to it.

G, G is a Belt of Buff, at one End of which is the Buckle H, and the other End I is pierced with Holes for easily passing the Tongues of the Buckle.

K, L are two small Straps coming from the lower Edge of the Belt G.

m, n are two small Buckles fastned to the Bend-Leather.

The Patient having the Thigh of his Breeches fitted to his Stump, so that the prominent raw Part, with the Dressings upon it, passes through a Hole left in the End of the Breeches, the Stump is put through the Bend-Leather into the pyramidal Box, which does not allow the raw Part to sink to its Bottom; and the laced Part D is brought to answer to the Course of the large crural Vessels on the Inside of the Thigh: Then the Lace is drawn so tight, that the Bend-Leather may grip the Thigh all round, by which the whole Weight will not rest upon the Cicatrix of the Stump on the Sides of the Box; but the Teguments of the Thigh all bear a Share, while the tight Lacing will have no bad Effect in stopping the Circulation, the larger Vessels

being free from any Compression: E comes up on the Outside of the Thigh as high as the great *Trochanter*, and F covers the *Glutæi* Muscles; and being pliable, allows them and the Joint to move easily. The Belt GG is then fastned round the Loins, and the Straps K, L are secured by the Buckles m, n, to support the Instrument in the Inside of the Thigh.

If the Belt GG does not support all well enough, a Suspensory must be put over the Shoulders, to be fastned to it at two different Parts both before and behind.

Any who read the preceeding History, and consider the Nature of the Matter evacuated at the Sinus, its small Quantity, the feverish Symptoms coming upon this, Nature's Effort to throw it off by a new Suppuration, and by the Skin where it erodes the Conduits, it could not pass; and the Hæmorrhagies, *Fungi*, &c. that came on afterwards, will observe very strong Marks of a sharp purulent Matter reassumed into the Blood; and from the Success of this Case, Surgeons may be encouraged to undertake Operations to Patients with very unfavourable Symptoms, when they can thereby take away a *fomes purulentus*, or any other Cause upon which the Symptoms depend. That it may not be thought I recommend bold Operations from the Success of this single Instance, I must tell you, that among the small Number which our Infirmary, so lately erected, can maintain, there are several such other Cases recorded. I. *Patrick Higgins*, fourteen Years of Age, with the Bones of his Leg carious, hectic Fevers, colliquative Sweats and Diarrhœa, was received

Fig. 3.

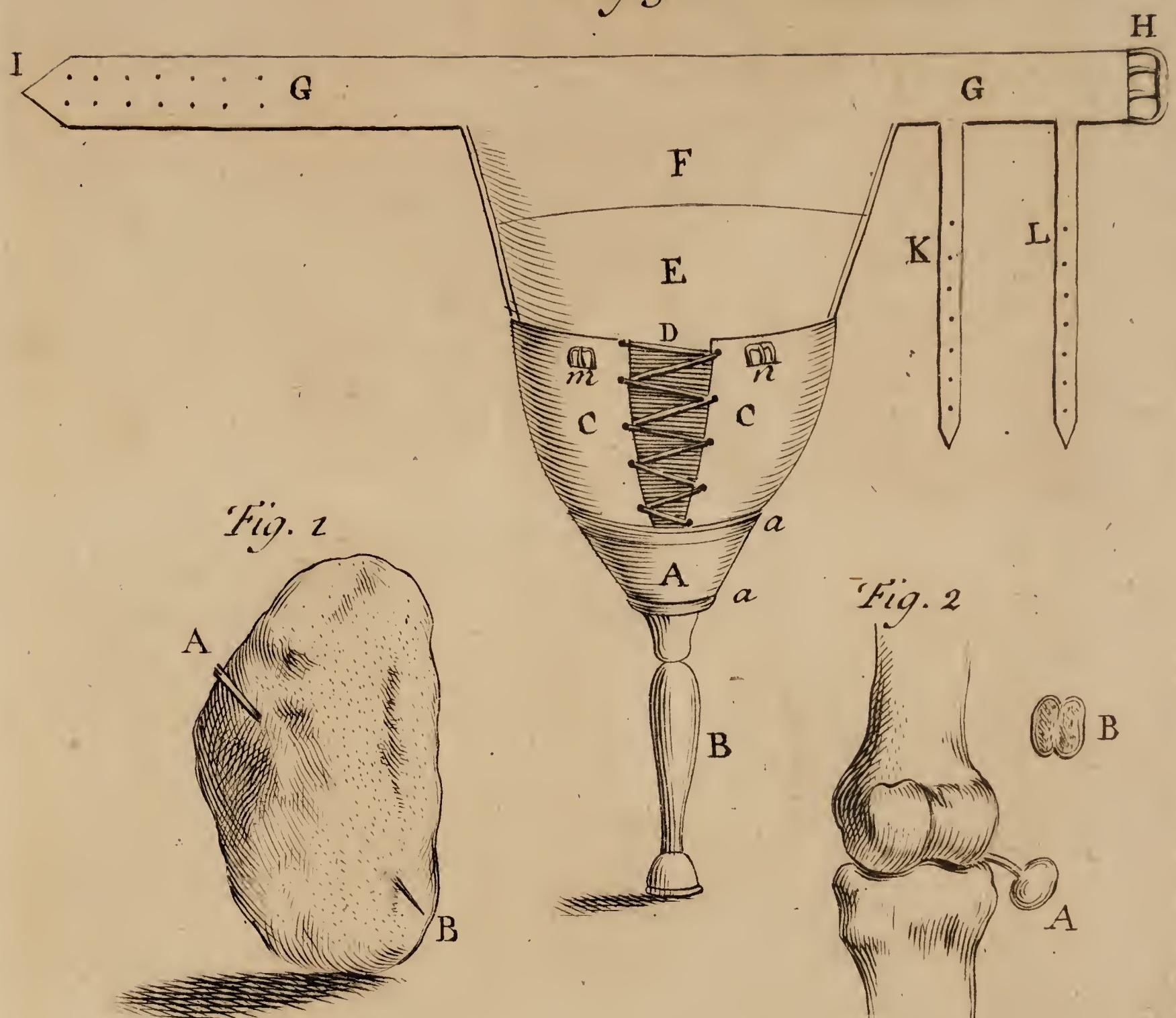


Fig. 2

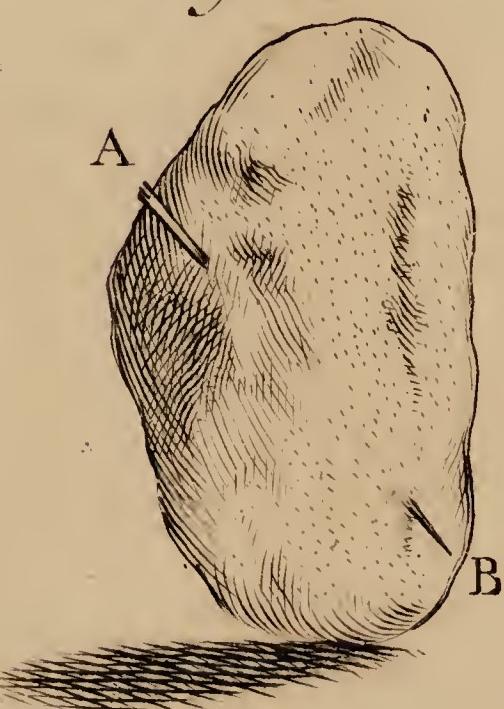


Fig. 2

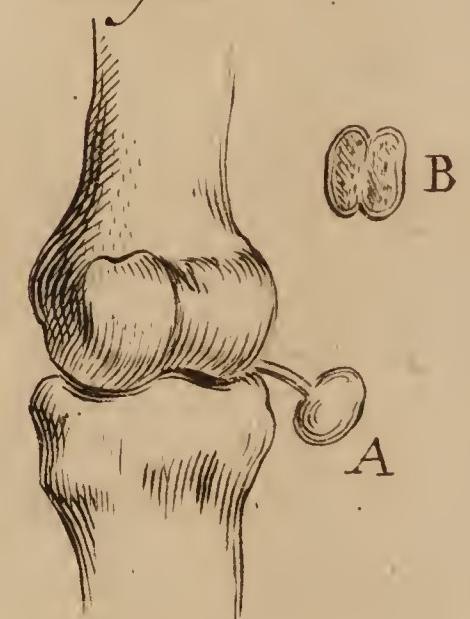
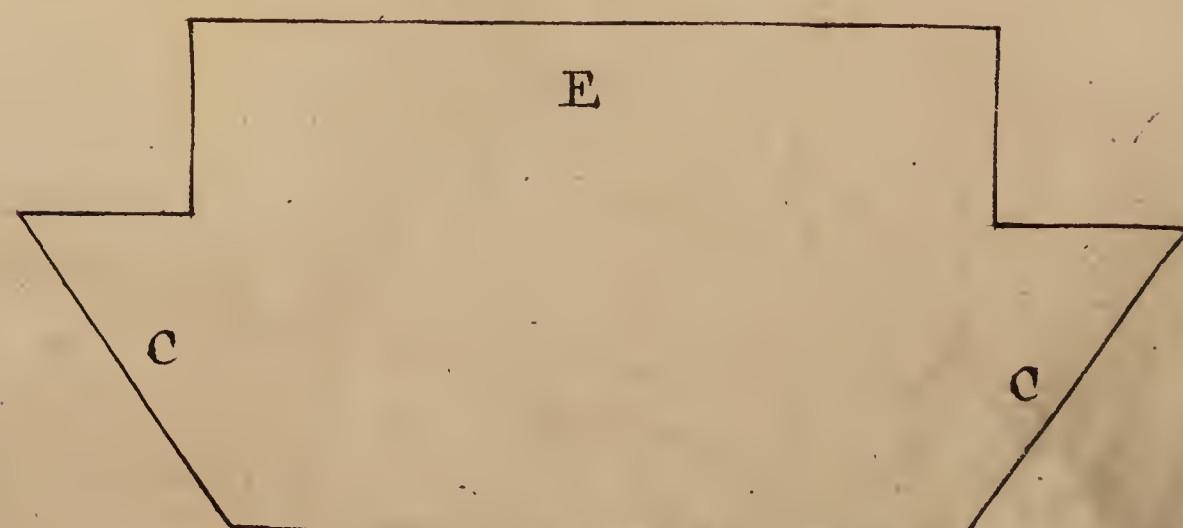
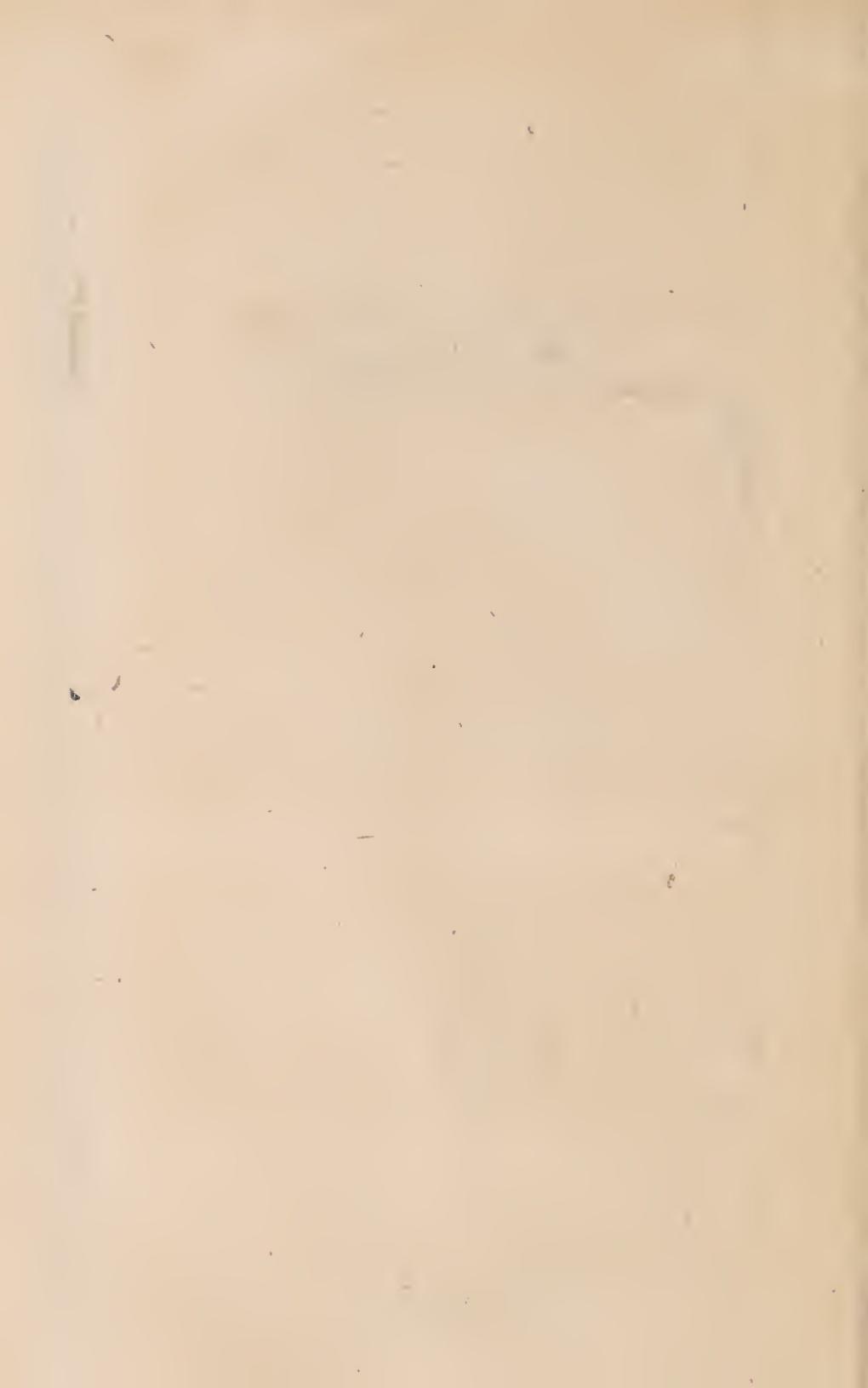


Fig. 4.





ved into the *Infirmary*, September 17. 1730. where his Leg was amputated, and went out of it plump and strong, with a firm Cicatrice, 21st December thereafter. 2. *Margaret Cleg-horn*, hec^tick, weak and emaciated, with the Bones of the Foot and Leg carious, was admitted 2d March 1732, underwent the same Operation, and was perfectly cured. 3. *Isabel Blackader*, whose History I have already related. And analogous to these Cases, I have seen People in much the same Circumstances from very large ulcerated bleeding *Cancers*, large internal Abscesses of the Liver, Kidney, &c. who recovered daily after the Amputation of the Cancer, or opening the Abscesses.

XXII. Remarks on the Amputations of the larger Extremities; by the same.

IN the Operations of Surgery there are a Number of little Circumstances, several of which seem at first View to be of no great Consequence; but when their Observation or Neglect comes to be attended to in Practice, they are found to contribute considerably to a speedy or tedious Cure, to bring on or prevent bad Symptoms, to keep the Patient easy, and preserve him, or to put him to Pain, and bring him into Danger; and therefore their good or bad Effects ought to be duly considered, and the proper Cautions concerning them ought to be given by those who write for the Publick upon such Subjects. In which Particular our chirurgical Authors are for most part very negligent; as an Example of this, I shall make some Re-

marks on the *Amputations of the larger Extremities*, an Operation, than which there is none of those that are called the greater or more dangerous, more frequently performed, and about which the Directions seem to be very particular, and confirmed by the frequently repeated Experience of Authors.

This Operation of Amputation consists in a proper Precaution to prevent any Hæmorrhagy during the Operation; cutting all the soft Parts, which cover the Bone or Bones; sawing it or them through; securing the cut Vessels from bleeding afterwards; and dressing, so as to promote a safe and easy Cure. In this Order then I shall make my Remarks.

THE Precaution taken to prevent a Hæmorrhagy during the Operation, is by applying Petit's, or the common Tourniquet. I shall refer to what the Contriver Mr. Petit says (*a*) of the Advantages and Conveniencies of his Instrument, and shall only consider the common one, which Surgeons, who generally have not, or do not know the other, do commonly make use of. It consists of a thick Substance, to be placed on the large common Artery of the Member, for compressing it; a circular Compress to be put round the Limb, to defend the Teguments; a strong Strap that is to be twisted; a small Stick with which the twisting of the Strap is to be made; and a small Piece of Pasteboard or Horn, to allow the twisting to be made more easily, and to defend the Teguments below the twisted Part from being hurt by it.

Several

(a) Mémoires de l'Acad. des Sciences, 1718.

Several French Authors order a thick Compress to be placed over the Artery for its Compression ; but a Roller, which our Surgeons generally use, is much preferable ; because, as the Arteries ly deep in the Interstices of Muscles, between which the compressing Substance must sink before it can affect the Arteries, this cannot be done near so well by the plain Surface of a Compress, as by a convex Roller.

The Size of this Roller must be proportioned to the Distance between the Muscles, and to the Depth of the Situation of the Artery. If the Roller is too thick, it will be born off from the Artery by the Muscles ; and if it is too small, the Muscles will hinder the twisted Ligature to press it sufficiently on the Artery.

Not only must the Size of the Roller be regarded, but Care must be taken to roll it up of a due Firmness : If it is too soft, it will have the Fault mentioned of the Compress : If it is too hard, it presses with too narrow a Surface, from below which the Artery may slide, and the Circulation may therefore be continued in it, after the Ligature or Strap is fully twisted. One must easily judge that such a Firmness is required in the Roller as allows it to retain its cylindrical Form, till a considerable Force is applied to make it a little flat.

Authors in their Writings, and Surgeons in performing this Operation, are uncertain in the Application of the circular Compress of the Tourniquet ; some putting this Compress round the Member, before they place the Roller on the Artery, which may be attended with very bad Consequence : For if it is wrap'd loosely

round

round, it comes to be wrinkled and doubled by the twisted Strap, which both hurts the Skin, and hinders the twisting. If it is put tight round, it keeps off the Roller from sinking between the Muscles, and the Hæmorrhagy is not prevented, as I have seen happen both from this Cause and too hard a Roller. The Roller ought therefore always to be applied first upon the Artery, and then the circular Compress is to be drawn tight over both Roller and Member.

If the Roller and Compress are not sewed to each other, the Roller may sometimes be in hazard of shuffling out from below the Compress in the Time of the Operation, and for most Part will do it when the twisting Strap is left loose after the Operation, and all the Dressings are applied, which may be attended with Danger of Hæmorrhagy during the Operation, and the Surgeon is disappointed of using the Tourniquet so quickly as he would wish, if any bleeding happens after the Operation. Not only therefore ought the Roller and Compress to be sewed together, but the Ends of the Compress ought to be so secured that it may not fall off.

I have nothing to remark on the common Directions for the Strap, Pasteboard, Twisting-stick and the Twisting, unless to take care that the Strap is strong enough, and no way worn, lest it break, and the Vessels are let loose upon the Operator in the Middle of the Operation. If such an Accident should happen, the Surgeon had need to keep his Presence of Mind, which if he does, there will be no great Danger; for an Assistant may supply the want of the Tourniquet, by gripping the Roller firmly, till

till either a new Strap is provided, or rather till the Surgeon has finished the Operation, which it is his Business to do, in such Circumstances, as quickly as he can. Nay though there is no such Assistant, the Surgeon, by sawing the Bones through very quickly, and then putting his Fingers on the large Arteries, till he has brought the Stitches round them with the other Hand, may prevent too great a Loss of Blood.

In cutting the soft Parts which cover the Bones, all Care should be taken to have the Skin and Bone as equal with the Surface of the Wound in the Muscles as possible; for if the Skin is retracted much in the Circumference of the Wound, and the Bone jets out far in the Middle, a tedious Cure is to be expected. For this Purpose the Skin is not only to be drawn firmly up, while the Fillet, which is put immediately above where the circular Incision is to be made, is applied tightly; but the Assistant who holds the upper Extremity of the Member, is to draw the Skin, and, if he can, the Muscles too, as tightly as possible, both to save them, and to keep them tense, by which they cut much more easily. And the Operator is not only previously to cut the Skin round, and then to make the circular Incision of the Muscles close by its upper cut Edge in the Thigh, and other Places where a strong Retraction of the soft Part is expected, as is recommended by some late French Writers; but after cutting the *Periosteum* round as near to the Flesh as possible, he is to scrape it upwards with the Edge of his Knife, by which the Side of the Blade must push upwards the Muscles which are next to the Bone,

Bone, and which retract least, because of their Connection to the Bone; so that the Bone being sawed near to the Flesh, the whole Surface of the Stump may be plain, without any pyramidal Prominence in the Middle, which not only protracts the Cure, by its larger Surface and Distance of the Skin from the Bone, but is a great Inconvenience to the Patient ever after, by the Prominence being perpetually galled with every thing that presses on it.

BEFORE the *Saw* is to be applied, a Piece of slit Linen is always ordered to be put round the Bone, wherewith the soft Parts may be drawn up and defended from the Teeth of the Saw. I have almost always seen one of two Inconveniences happen from this Piece of Linen; either the Surgeon applied his Saw so close to it, that the Linen was engaged in the Teeth of the Saw, which made it impracticable for the Surgeon to go on in sawing, till it was disengaged; or else to shun this, he left too much of the Bone without the Flesh, with a greater Chance of a tedious Exfoliation, and a Certainty of a pyramidal Stump. This Linen ought either not to be applied, from the want of which I never saw any Inconvenience, or it ought not to be allowed to touch the Bone, that the Surgeon may be at Liberty to apply his Saw upon the Bone close enough to the Flesh.

The common Directions are sufficient for the the Sawing.

To secure the cut Vessels from bleeding, the most common Practice is now to stitch the Vessels; for Astringents and other Stypticks are found altogether insufficient in such Amputations

tions as I now treat of. Causticks are both uncertain, and destroy more than is necessary. Compression by common Bandages cannot restrain the Hæmorrhagy, and Mr. *Petit's* new compressing Machine (*a*) if it is to be depended on, to stop the bleeding of Arteries in the muscular Part of the Thigh, at a Distance from any Bone; or if it can be applied to that Artery of the Leg which lies close to the Side of the Fibula, where it pierces through the Ligament between the Bones, will be long before it is in the Possession of most Surgeons. The Stitching then is only what I will consider.

The Form of the Needles employed here, and the way of making a thin flat Ribband, by waxing a Number of small Threads together for tying the Vessels, instead of the common round Threads formerly used, are now too well known to be insisted on.

In pushing the Needle round the Artery, the Surgeon should be careful to carry it, within the Substance he pierces, two Thirds or three Fourths of the Circumference of the Artery; for if the Thread is only lodged within the Flesh of one half or less of that Circumference, the Artery may be missed altogether in drawing the Ligature, or such a small Part of one Side of the Extremity of the Artery may be taken into the Noose of the Knot, that it will easily slide off; and though the Bleeding appears sufficiently guarded against at first, yet a fresh Hæmorrhagy begins soon after. I remember once to have

(a) *Memoires de l'Acad. des sciences, 1731.*

have seen this Accident occasioned in the Manner now described.

In passing the Needle thus, as few muscular Fibres, Tendons or Ligaments ought to be taken within the Noose as possible, but the Surgeon should attempt to thrust his Needle only through the cellular Substance in which the Arteries of the Extremities ly : For the Threads when drawn have greater Effect in bringing the Sides of the Artery together, when the Substance comprehended in the Noose is soft and thin, than when it is firm and thick ; less Pain is given by shunning the nervous Parts, less Substance is lost when the tied Parts fall off, and there is no such Danger of the Stitches being so long in casting off, and consequently of the new Flesh growing over the Knots so far, that they are scarce to be come at to cut them away, without Danger of opening the Artery again ; or by leaving the Stitches, sinous Ulcers are formed in the Stump, and no Cure can be made. I have more than once seen all those Inconveniences, from more than was necessary being taken into the Noose of the Thread in stitching Arteries. This which I look on as a hurtful Practice, has some Reasons to support it, which has brought People into the Exercise of it, such is the Fear they have of the Thread's cutting the Coats of the Artery in tying, unless some other firm Substance is taken in. But this none who makes Use of such flat Thread as I mentioned, and has been the least accustomed to make such Ligatures, is in any Danger of ; nay, it is not in any one's Power to cut the Coats of an Artery with such Thread,

Thread, by the sole Force of Tying; indeed by pulling outwards at the same time he makes the Ligature, the Surgeon may tear the Artery, but this every Surgeon guards against. Next, it may be said in Defence of comprehending the firmer surrounding Parts within the Noose, that otherwise the Ligature may be pushed by the Force of the Blood over the Extremity of the Artery: But this will be found to be without Foundation too; for as soon as the Ligature is made, the cellular Substance beyond the Stitch, having still a Communication with the surrounding Cells, swells and turns firmer and harder, so as to prevent the Thread from sliding.

That Fear of cutting the Coats of Arteries in tying the Threads, makes Surgeons frequently tye them too loose; if the Blood is stopt, they require no more. But they ought to consider, That Threads tying Arteries only come away afterwards, by the tied Parts mortifying or suppurating away, and that the sooner such Corruption is brought on (which will be exactly in Proportion to the Tightness of the Ligatures) the Separation of the Threads will be the more speedy. The Rule therefore will be, that where the Artery is very large, and consequently where the Plug of coagulated Blood obstructing its Orifice, the firm Concretion of its Sides, the new sprouting Flesh or whatever else it is that blocks up its Orifice, must be longer in forming, the Ligature is not to be so very tight that its Separation may be longer in making, and all Hazard of Hæmorrhagy may be shunned. But where the Artery is not large, the tighter the Threads are drawn, so much the better, that

they may sooner fall off, and the Cure may be more speedy.

It may be easily judged from what has been said, that the Compress of Linen recommended by some Authors to be put between one Side of the Artery and the Noose of the Thread, cannot be approved; the Effects of it being to prevent the tight enough Ligature of the Vessel; and if it should shuffle out soon, an Hæmorrhagy must be expected; or, if it remains, the *Pus* which it imbibes will become too acrid.

After the two Knots are made on the Ligatures of the Vessels, several Writers recommend the Thread's being left of such a Length, as to turn over on the Side of the Stump; but when this is done, the Blood or Matter which comes from the Wound, never fails to glue those Threads so firmly to the other Dressings, that these can scarce be brought off without the Threads being pulled more or less, which endangers the tearing the Extremities of the Arteries, or making the Threads slide over them, to occasion an Hæmorrhagy; whereas, by leaving the Threads so short that they can scarce reach to the Edge of the Wound, they are always kept moist, and so cannot adhere to the Dressings, to run that risk.

In Amputations, the Surgeon ought not to content himself with tying only such Vessels as he observes throwing out Blood, while the Patient is faint with the Pain, but he should endeavour to rouse him from that faintish State by a Cordial, and then wiping off the coagulated Blood with a Sponge wet in warm Water, he should examine narrowly all the Surface

off

of the Stump, to discover the bubbling Streams, to secure them before the Dressings are put on, otherwise he may expect to be obliged by a fresh Hæmorrhagy to undo all.

At first Dressing, Surgeons use to be very anxious about the Bleeding, and for that Reason applied great Quantities of astringent Powders: but these were observed to purse up the small Vessels too much, and thereby to retard the Suppuration; while by the hard Cake which they form, they gall the Wound, and cannot be taken off without much Difficulty and Pain, and therefore they have been long disused in this Country. In place of which Pledgits wet with hot *Oil of Turpentine* were applied: This gave very sharp Pain, and by it sometimes there is Hazard of bringing on an Hæmorrhagy at its first Application, afterwards it hardens the Vessels and resists the Suppuration, and never misses to scald and blister the Skin round the Stump, and thus creates such Pain as the Patient complains more of than he does of the Wound. If the larger Vessels are well tied, and no Fault is committed in applying the other Dressings, there is Occasion for no other Application to the Wound than the Threads of soft half-worn Linen, which the French call *Charpie*, the English, *Lint*, and we *Caddiss*, which is a gentle Absorbent, is soft and easy to the Wound, and by the corrupting Liquors it imbibes, proves one of the strongest, most mild and safe Suppuratives.

Great Pains were commonly taken to form the Lint into neat Pledgits before it was applied, but it is impossible to make Pledgits

without folding the Extremities of the Threads where it becomes thicker and harder, and so makes an unequal Pressure, which produces several ill Effects. I have often seen Wounds changed to the worse, by the unequal Compression of Pledgits, Compresses and Bandages of one Dressing. In order to shun these Inconveniences, the Lint needs only to be laid into thin Parcels, as is done when Pledgits are to be made; with these the Inequalities between Bones or elsewhere can be perfectly well filled up, and an equal soft Compression can be made on the whole Surface of any broad Wound or Ulcer; in all which the Lint ought always to be applied in the Form just now mentioned.

This Way of Dressing makes, you see, the Compresses that are commonly desired to be put on the Extremities of the Arteries, and the particular Pledgits for the Bones altogether unnecessary.

The *Malta* Compress is pretty well contrived, though it would be better to have a Cap of Woollen, or some such Substance, that would contain the Stump, without any Part being doubled or folding over another, as must be done with the Angles of the *Malta* Compress, which therefore make an unequal Pressure on the Parts of the Skin they are applied to. The two long Compresses that are ordered to be applied cross the Stump upon the *Malta*, seem unnecessary, if not hurtful; for being made to cross on the middlemost prominent Part of the Dressing, they press only the Bone, which answers no Purpose, and they hinder the equal Compression which ought to be made by the Bandage

Bandage on the other Parts of the Wound. At the same time, the Ends of these Compresses which are laid upwards on the Member, bruise and gall the Skin when the Bandage is applied tight upon them. I have seen them sunk their whole Thickness into the Skin. It will be sufficient to place a narrow thick Compress on the Course of the large Artery, to moderate the Course of the Blood in it, or rather this may be done by crossing the Extremities of the circular Compress, which is put round the Member, upon the Artery.

Notwithstanding all the effectual Methods we now have for preventing an Hæmorrhagy in Amputations, Surgeons still continue to act as if they were as much afraid of it as they had Reason before either *Tourniquet* or *Stitching* were known; and by this do several hurtful Things; among the rest, the too tight Application of the Bandage upon the other Dressings, is one: If the Circulation is not entirely stopped, and a Mortification brought on by it, they think it cannot be too tight. But besides this Hazard of Mortification, there are several Disadvantages which they are exposed to by this Practice, whereof the very Thing they are afraid of, the Hæmorrhagy is one, as I shall endeavour to demonstrate, in considering the Effects of the different Turns of the Amputation-Bandage applied tightly.

The longitudinal Turns of the Bandage which are made to pass over the Middle of the Stump in different Directions, to cover it all over, exert their greatest Power against that middle Part where the Bone is, which bears off

their Pressure from the other Parts, and the large Arteries which shrink up farther than the Extremity of the Bone, cannot be affected by their Pressure. If this middle Part is shunned in making the longitudinal Turns, the Flesh only is pressed, and therefore will be thrust upwards from the Bone which is left prominent and bare, to occasion a tedious Cure, and at last a pyramidal Stump, which is always after uneasy to the Patient. The immediate Effect of too great Pressure on the soft Parts, is to hinder the small Vessels to discharge themselves, which creates Pain and Inflammation, and does not allow the Suppuration to come on. I had Occasion to see this prettily confirmed in the Case of one *James Spence*, who had the Amputation performed in the Middle of the Fore-arm, in the Infirmary here. By changing the Posture of the Fore-arm soon after the Operation, he had made the longitudinal Turns, which went also round the Elbow, tighter than they were at first applied. Three Days after, there was not the least Appearance of *Ichor* coming through the Dressings, nor any suppurating Smell; his Pulse became quick, and he complained of Pain, Throbbing and Girding in the Stump. I judged what was the Cause, and cut all the longitudinal Turns at the Elbow; in few Hours after, his Complaints were all gone, the exterior Dressings were stained with the Liquor ouzing through them; next Day all the Symptoms of a mild plentiful Suppuration were seen, and the Cure was soon compleated.

The circular Turns of the Bandage when
tight

tight, must stop the Return of the Blood in the cutaneous Veins, and by making thus a greater Resistance to the Blood in the Arteries which anastomose with them, will occasion the contracting Power of the Heart and Arteries to dilate and force more Blood into their other Branches; but these being cut in the Amputation, will pour out their Blood, and so an Hæmorrhagy is brought on. Analogous to this it is, that when a Ligature is put round the Arm or Leg, it becomes all red below, the lateral Branches having much more Blood thrown then into them than they had when the Circulation was free. It can be to this Cause only, that a Phænomenon, which surprises many Surgeons, is owing, to wit, after dressing a Wound according to Art, it bleeds; upon taking off all the Dressings, not a Drop comes out: If the Surgeon wisely thinks to prevent any further Bleeding, by still a tighter Bandage, the Hæmorrhagy is greater, unless he will chuse to risk a Mortification. To satisfy some Gentlemen fully of the Truth I argue for, I took the Management of a *Tourniquet* while the Ampuation of a Thigh was performing; after the large Arteries were all stitched, I let loose the *Tourniquet*, scarce any Drops of Blood fell from the Stump. I then gradually twisted the *Tourniquet*; whenever it became a little tight, the whole Surface of the Wound seem'd ouzing Orifices of Vessels. I twisted it again fully, and stopt them all; then untwisting gradually, shewed them the same bubbling Scene, till the *Tourniquet* was quite loose, when no more Blood came.

From

From the whole I would conclude, that no more is required of the Bandage than to press the other Dressings very gently to the Wound. If a Surgeon is to fall into any of the Extremes of too loose or too tight Bandage, the former will, in my Opinion, do much less Harm than the latter.

Our *British* Surgeons would do well not to be so free in Blood-letting as the *French* Operators direct. I shall not now examine whether the *French* Constitutions require this Evacuation more than we do, or whether so frequent and plentiful Evacuations of Blood is a faulty Practice among them, introduced at first by a mistaken Theory, and prevailing afterwards by Custom: But this is certain, that though Bleeding is exceeding necessary in plethorick Habits that undergo the Amputation, and is the grand Remedy when Fever and Inflammation seize a Patient after this Operation, it is by no means a general Rule, that all who suffer Amputations should be let blood of either before or after the Operation; for I have in many Instances seen the Cure performed without one bad Accident, when the Patient has scarce lost two Ounces of Blood in the Operation, and was neither blooded before nor after it: And on the contrary, I have observed in the Hospitals at *Paris* and elsewhere, People sink under the Loss of Blood, dying with oedematous Swellings in several Parts.

What I find has induced Practisers to imagine, that in Amputations there was a greater Necessity of letting Blood than in other Wounds of equal Extent with the Stump, is their supposing

posing that immediately upon a Limb's being taken off, the remaining Arteries of the Body are obliged to circulate the Quantity of Blood they contained before, with the Addition of what was sent to the amputated Member; which additional Quantity they pretend to relieve them of by Venæsection: But when it is considered that the amputated Member takes away its Proportion of the Liquors of the Body with it, and therefore leaves no more in the other Vessels than they contained before, the Reason for this Practice must cease. For some Days after the Operation, the Patient is always kept on a spare low Diet, to prevent any Fulness, and consequently there is no Occasion for bleeding in the first Days after an Amputation, on account only of any *Plethora* the Loss of a Limb can be supposed to bring on. Afterwards indeed when the Patient comes to recover his Appetite, and a fuller Diet is allowed, it is reasonable to think a *Plethora* may be brought on by the *chylopoietick Viscera* preparing a greater Quantity of Chyle to be mixed with the Blood, whose Vessels will be too much crowded, because of the Want of those that have been cut off. For which Reason it is necessary for all who have lost a large Member, after their Recovery, to use a spare Diet, or to make frequent Evacuations, otherwise they will probably be subject to the plethorick Diseases.

The Cases then in which Blood-letting is required after Amputation are, when the Patient is of a full Habit of Body, and has lost little Blood before or in the Time of the Operation,

or

or when there is violent Pain and Swelling in the Member, without being occasioned by any Application made to the Stump; or when the Pulse becomes very quick and strong, with Heat, Thirst, and other feverish Symptoms; then indeed Blood-letting, suited in Quantity and Repetition to the Symptoms and Strength of the Patient, is absolutely necessary. But if in the first three or four Days after the Operation, the Pulse is only a little more frequent than ordinary, without violent Pain or other bad Symptom, a low Diet, with cooling Drinks and laxative Clysters, if the Patient is costive, will be sufficient.

The Physicians and Surgeons of the *Royal Infirmary* here have always followed the Method above-mentioned, and have not lost one Patient of fourteen who have had Amputations of the larger Extremities performed.

It is generally too soon to take off the first Dressings on the second, third, or even fourth Day after an Amputation; for they still adhere to the Wound, and cannot be brought away without Pain and Bleeding: And there being no such effectual Suppurative as the Liquor sent out from the Wound, the fifth, sixth or seventh Day is generally soon enough for removing the Dressings. If the Smell of the *Ichor* of the Wound becomes in the mean time very strong and offensive to the Patient, it may be necessary to cut the Band, and with the Assistance of Scissars to take off the Compresses and exterior Part of the Lint, on the third or fourth Day, and to apply clean Things in their Place; but the Lint next to the Wound ought not

not to be removed, till the Suppuration moistens and separates it.

At the second Dressing there is no Occasion for any other Suppurant, than not to be too anxious in cleaning off the Pus that adheres to the Stump; all Moisture upon the Skin being carefully dried, to prevent Excoriation.

Nothing contributes afterwards more to a speedy Cure than dressing seldom. The Rule that might be taken from Nature is, to wait till the Patient is sensible of an uneasy itching in the Wound; which shews the Pus is beginning to turn acrid, which commonly happens every second or third Day. And as I hinted formerly, an equal gentle Compression is of great Use in keeping up a right Suppuration, and preventing the Growth of spungy Flesh.

If the Threads with which the Arteries were tied should remain too long, (that is, three Weeks or a Month, according to the Largeness of the Artery) and the new sprouting Flesh covers the Ligatures, they had best be cut out, lest by the growing of the Flesh they should become so much covered, that they can scarce be come at, and sinuous Ulcers should be formed, to prevent a Cure. The best Method of making this Excision is, to take hold of the depending Threads, and to introduce a Probe or small Directory along them, till it enters the Noose, which is easily known, by drawing the Noose very cautiously outwards with them; for the Resistance which the Thread makes will very plainly be felt. Upon the Probe or Directory, slide in one Blade of a Pair of Scissars a little opened, till the Point of it is where the other

Instru-

Instrument was, and the Point of the other Blade is consequently on the Outside of the Noose when it is snip'd in two, and is easily drawn out. In bringing the Threads away in this cautious Manner, there is no Danger of bringing on an Hæmorrhagy from the Artery round which the Thread had been tied; for long before this Time, so much of what was taken at first into the Noose must have fallen off, to make it quite loose, and without any Effect upon the Artery.

If the Patient is of a tolerable Habit of Body, and is managed in the Manner above described, dry Lint, and sometimes touching the sprouting Flesh with *Lunar Caustick*, are all the Medicines necessary towards a compleat Cure, without any Exfoliation of the Bone; which the Surgeon ought to be so far from endeavouring to promote, unless he sees the Bone corrupted by some Accident or Mismanagement, that on the contrary it should be his Study how to prevent it. The common Methods for which, as also for procuring an Exfoliation, are in my Opinion very faulty: I may possibly inform you hereafter of my Reasons for thinking so, and shall only just now remark, that of the fourteen who suffered Amputation in the Infirmary, there was no Exfoliation from any of their Bones, except from the Thigh-bone of *Alexander Sheppard*, whose History I have already sent you. In two others, *Isabel Blackader* and *John Macmillan*, who had the Amputation also performed above the Knee, towards the End of their Cure there was a very small Piece or two of Bone observed among the Pus;

but

but in no other was there any thing like Bone seen to come off, though in some of them it was thought altogether improbable to prevent some Corruption and consequent Separation of a Part of the Bone, particularly in *Margaret Cleghorn*, whose *Tibia* and *Fibula* were so spongy at the Place of Amputation below the Knee, that had their Condition been known before, the Knife might have been made to cut them through, as well as the Teguments and Muscles. Notwithstanding which, and a bad hec~~t~~ick Habit of Body, both Bones were quite covered with Flesh at the third or fourth Dressing, the Wound healed soon, and the Cicatrice has remained now firm several Years.

In these Remarks on Amputations, I have blended the Rules of Management so with the Reasoning, that several Readers will not at first have a full orderly View of all the Steps to be taken in performing this Operation after the Manner I have proposed; nor do I design to sum up the *Agenda*, on purpose that those who have most need of Rules, I mean the young Surgeons, may have them more firmly fixed in their Memories, by taking the Trouble to compare what they read in the Books of chirurgical Operations with what has been said here, and then to form for themselves a compleat Description of the whole Operation and Method of Cure, by following the Order I have done, but supplying from their Books what is here superficially passed over as being common, and changing the ordinary Directions for such of mine as they shall think reasonable and confirmed by Practice.

XXIII. *An Essay on nervous Fevers: In a Letter to Dr. JOHN STEVENSON Physician in Edinburgh, from Dr. EBENEZER GILCHRIST Physician at Dumfries.*

HAVING had a good deal of Practice off late *, in Fevers of the *low Kind*, commonly called *nervous*, by some, *internal, influent, depressed*; I venture to offer you some Conjectures upon the Nature and Cure of them; minding as little as I can what Authors have said, I shall give you the Thoughts just as they arose.

I have never yet been able to follow out some in their almost endless Divisions of Fevers, nor in the Causes they assign for them. As little can I be satisfied with those who would allow but of one general Cause of Fevers. Tho' *Obstruction* may be frequently the Cause, I believe it is sometimes more an Effect than a Cause. But Obstruction does not give a compleat Notion of the Disease; nor by it alone will we be able to conceive justly the Method of Cure. The Part principally obstructed, the Nature of the obstructing Matter, and severall other Circumstances must be well considered. It is not easy to say whether it be certain *Miasma*, Disproportion of Parts, particular Acrimony, Exaltation of some of the Principles of the Blood, or undue Attraction of them, that occasions this disorderly Motion. And as amongst so many different Opinions we are left in Uncertainty, in order to be satisfied as to

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the Cause of this, or any other Distemper, we are obliged at last to trust to our own Senses and Reason.

This Kind of *Fever* I would speak of, has been these many Years fatal in *Britain*. I shall not account for its Frequency, how far it may be owing to the Manner of living, and a long Course of warm and rainy Seasons. It would be but an unsatisfactory Piece of Theory perhaps, to shew how these Causes bring on such a State of the Fluids as is observed, or may be justly suspected in this Fever.

For a History of the Disease, I incline to give a Description of it, as it had different Appearances in different Persons. Young People generally complained of Pains or Stitches the first Days; by which I have been deceived, taking the Case sometimes for a slight Rheumatism. Their Complaints otherwise were but few. The Pulse was not much different from natural. Their Sleep was pretty natural, and the Sickness was rather Heaviness, with some Degree of Faintness. Under such moderate Symptoms I have been secure, till a *Delirium*, or Signs of it, shewed the Danger: And those who seemed to be in no Danger the first Days, for most part died.

In others the Seizure and Symptoms, the first Days, were more violent. They had Vomiting or *Nausea*, Head-ach, full, strong, or hard Pulse, Heat and Thirst, Redness of the Eyes. The Case then having a good deal of Inflammation in it, it was necessary to bleed once and again; and the Symptoms were considerably lessened by it. This did not always happen: But by the Time that a *Delirium* came

on, the Signs of Inflammation were much abated, the Pulse was low and contracted, the Heat moderate, and they were altogether as those who in the Seizure had but small Signs of Inflammation, were not bled, nor indeed would bear it.

Sometimes they would languish two or three Weeks, before the Disease formed into a Fever; and it stole on so insensibly, that they were in Danger before we were aware. In this Case there was no reckoning of Days, for it was not known when they were seized. In short, as to the Manner of Seizure, there was great Difference, but the Disease in the Progress and Height was always the same.

When the first Symptoms were over, an obstinate *Delirium* came on, sooner or later, for most Part very early. Sometimes there was Looseness, with Pains of the Belly; partial Sweats, which gave no Relief; tickling Cough, and more or less of Faintness. Soon after a *Delirium* came on, the mortal Symptoms appeared. In some the *Delirium* did not come to such a Height as in others, nor was it constant; but at Times they would talk reasonably, even when a *Subsultus* was upon them. These lay much dispirited, and wasted fast, without any, or but very little increased Evacuation. In some such I have observed a fatty Pellicle upon the Urine. Continual, cold, clammy Sweats are sometimes observed: At other Times they, as it were, melt with profuse Sweats, as if Water were sprinkled upon them, and the Skin feels Death-cold.

I have only taken notice of the more obvious

ous Appearances and remarkable Differences of Symptoms; not needing to make a nice Enumeration of them to one who has so often observed them.

It was the poorer sort, and those a Degree above them, who were subject to this Fever. I knew but few Instances of it amongst those who lived well; and of Wine-drinkers, I do not remember that there was one seized.

Though I am not for multiplying Causes in this, or any other Distemper, I would here suppose two very different States of the Fluids: A Siziness or rheumatick *Lentor* of the Blood, tending more or less to Inflammation; and a too great Dissolution of it: Of which we have some Notion, when it is said the Blood is poor, vapid, effete. It was from the first of these that the Fever with us generally proceeded, and it is in this View that I design to consider it: For when *Bleeding* was necessary, we almost always found the Crust at Top more or less tough and compact; and when we durst not bleed, the Symptoms gave Signs of this *Lentor*. The Tongue was for most part only white and moist, seldom very dry, black or chapt; which argues neither Ardency nor Defect of the Fluids. The Urine was much like that in Health, sometimes redder; a thin, meally, dusky Sediment was mostly observed, or a thick Cloud falling to the Bottom: A *Crisis* was not to be judged of by the Urine.

This Want of a natural *Sediment* may be owing to different Causes, depending upon the different Thicknesses and Velocities of the Blood. In ardent, sanguineous, inflammatory Fevers,

where the Blood's Motion is much increased, the Attrition is great, and the several Parts of the Blood are beat down, and so blended together, that in the Urine the different Principles remain confused, and never attract or separate. So likewise when the Fluids are thick, and there is but a small Increase of the Velocity, the watery Parts only will be separated by Urine; while the more solid of Oil, Salt and Earth, will be wrapt up and closely retained: Hence we do not meet with a Sediment. And this makes a large Flux of Urine, profuse Sweats, or increased Looseness, of bad Prognostick in this Fever.

This fizy State of the Blood is attended with more or less of Inflammation, as appears from the different Manners of Seizure. The more Tendency there is to Inflammation, the greater is the Danger. On the contrary, the Hazard is less as the Disease is farther removed from it, till there is Reason to think that the *Lentor* is in so small a Degree as not to be the Cause of the Fever; but that the opposite State of the Blood, *viz.* some Degree of Dissolution, is to be suspected, and then the Danger grows in proportion on the other hand. You see that to maintain the Supposition of two different States of the Blood, and that one or other of them is always the Cause of the Fever, I have fancied different Degrees of the morbidick Cause, alledging that when we come to the last or smallest Degree of Viscidity, the first or smallest Degree of Dissolution begins.

These different Degrees of Siziness cannot be better conceived, than by observing them

in

in other Diseases. In *Pleurisies* of the inflammatory kind, we find it in the highest Degree; and the most cooling, diluting, attenuating Method is little enough to dissolve it. We meet with it again of a middle Degree, in *Pleurisies* of the *cold kind*, that have something in them a-kin to a *Peripneumonia notha*: A Method very different from what is used in the former, must be followed here. The more we evacuate, the Disease continues longer, and the Stitch is more fixed. So that the very vulgar Rule, to bleed till the Crust disappear, or the Blood turn better, as they say, is very hurtful. But once bleeding, more or less, according to Symptoms; and giving volatile attenuating Things, with proper Diluents, and sometimes Blistering, answer all Intentions. This *Lentor* is found in chronical Cases, where it has little or no Tendency to Inflammation, and therefore is less apt to produce Obstruction or Fever.

How a *Lentor*, which of itself appears to be unactive should excite a Fever, I shall not take up your Time to explain; but I am of Opinion that it is this, which, according to the Season, manner of living and Constitution of the Person, produces Fevers continual and intermittent, *Pleurisies*, *Rheumatisms*, and other Diseases, pertaining to those of the inflammatory Kind; but that do not come fully up to their Nature. If we consider the Likeness and Complication of Symptoms in these Distempers, and how readily one of them is changed into another; for Instance, continual Fevers into intermittent, & vice versa; as also, those of a good kind into malignant: If we consider these, I say, we will

will have some Reason to think that the Cause is much the same in them all.

I have said that this *Lentor* is unactive; but then it is easily put into Motion, or so disposed as to produce any of these Diseases. By an Error in the *Non-naturals* it may be thrown upon some particular Part, or so fixed as to excite the Fever. This gives us the most simple Idea of the Disease, and is the most favourable kind of it, which will have several Degrees as the *Lentor* is more or less compact. We have another Idea of it, when it acquires an inflammatory Disposition, and the Disease will have different Appearances. When it is joined to a particular Acrimony, we have still another and very different Notion of it.

To determine the several Kinds of this Fever, the Degrees of it, and the Malignancy with which it may be attended, a Scheme might be made out in this Manner: Fever from a *Lentor* —— *Lentor and Inflammation* —— *Lentor and Acrimony* —— *Lentor, Inflammation and Acrimony* ——— 1, 2, 3, Degree of *Lentor, Inflammation, Acrimony*; and so on in the Division and Subdivision, if you please, of these: Which, according to the various Modifications of Matter in Fevers, and Combination of Causes, might be run out to a good Length; more for Amusement, I own, than any real Advantage in Practice..

What happens in other Fevers, deserves to be particularly taken notice of in this. I do not know how to call it, *a muscular Tension*, or *universal Spasm*; which does not appear so evidently as in Fevers, that have more of Inflammation

tion in them, but we may be very sensible of it from Effects. This *Lentor* and a *Spasm* consequent of it, essentially constitute the Fever: And all that is done in the Method of Cure has, or ought to have a Relation to one or other, or both of these.

As I make frequent Use of the Word *Spasm*, it should be explained. Every Effort of Nature to free herself of what is hurtful, is really a *Spasm*; which will be more or less violent, according to the Nature or Force of the stimulating Cause; and with which more or fewer Parts, according to the Nature of the Disease, are observed to labour. What are *Tremblings*, *Horrors*, *Rigors* in the Attack of Fevers, but a *Spasm* of the whole Body? What are Head-ach, Vomiting, Looseness, and all disorderly Secretions and Excretions, but a *Spasm* of some particular Parts, or Effects of a more universal *Spasm*? The same are all these Mischiefs that follow upon a wrong Administration of Medicines; such as, Increase of the Fever, Anxiety, contracted or irregular Pulse, which happen frequently from blistering, hot, stimulating Medicines, &c. Whatever therefore, to speak yet more properly, increases too much the *Oscillations* of the Solids, will be the Cause of a *Spasm*.

One general Observation, taken from the Pulse before and after the *Height* or *Crisis*, will further shew what I mean by a *Spasm*, and what Share it has in this Fever; whether it be reckoned a joint Cause or a chief Symptom, for this we know sometimes requires our greatest Attention. The Pulse before the *Height* is felt low,

low, weak, small, hard, irregular, contracted, being always below the Standard. There is a certain increased Degree of Circulation necessary for Resolution, Preparation and Expulsion of the Matter of Diseases. As the Fever goes off, or a *Crisis* succeeds, the Pulse becomes full, firm, soft and strong; and if it has not these Conditions, the Patient hardly recovers, or he suffers a Relapse. This remarkable Change of the Pulse cannot be well accounted for, but upon the Supposition of a *Spasm*; which abating at the *Height* of the Disease, gives Room to the Blood to flow equally into all the Vessels. The quite contrary happens in sanguineous and inflammatory Fevers, where, before the *State*, the Pulse is full, hard and strong; but after, it becomes small, weak, languid. This makes me think that the *Crises* must be explained in a different Manner. If we would still have a clearer Apprehension of the Nature of this Disease, we should separate the *Fever* from the *Delirium*, and consider them singly. Let us imagine a Fever of this kind performing its Course, and no *Delirium* attending it. We may suppose one will bear up a good while under it; even when there are considerable Degrees of Malignity; while the several Functions are performed, or not much lesed, and the Matter is free in the Vessels, which by repeated Circulations will be at last concocted, and the Fever determined.

But when a *Delirium* comes on, there is really a new Disease formed, not necessarily depending upon the Fever, but from a particular Disposition of the Matter of this Fever, more than

than of any other to take to the Head. The analogous Symptoms of the Fever and *Delirium* conjunctly, will serve now to increase the Cause, or heighten the Appearances of the Fever, beside the Symptoms peculiar to the *Delirium* itself.

The Symptoms in a Head-ach, for ordinary the Forerunner of a *Delirium*, and which we shall suppose to be in the Membranes of the Brains only, are Coldness and Trembling, Nausea and Vomiting, straitning of the Breast and *Præcordia*, involuntary Motions of Head and Neck, contracted, irregular and sometimes intermitting Pulse. These are all the Effects of a Spasm. When an Obstruction is formed in the Brain itself, another Set of Symptoms appears. Beside these mentioned, the Functions are not performed, the Faculties are impaired or lost, the Secretion of a Fluid in the Brain is in some measure hindred: This occasions an irregular Distribution of Spirits; for while they are not secreted into some Places at all, they are violently or unequally sent into others. Hence proceeds all that Variety of unnatural Actions and Motions observed in delirious People; Startings, *Subsultus*, Convulsions, which are all greater Degrees of a Spasm. A Fever with a *Delirium* must be considered as a complicated Disease.

It will help a good deal too, in forming a Judgment of this Fever, if we examine what Proportion the Fluids bear to the containing Vessels. The Quantity is seldom more than the natural, I mean as it is found in a well-constituted Body; sometimes less. The Appearance
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of Fulness in the Beginning of the Fever, is rather from some Degree of Inflammation than a *Plethora*. Here then is a *Stricture* of the Vessels in a collapsed State, or where their Sides are brought nearer together, by which the intervening Fluids are strongly compressed. This gives a Notion of it, very different from what we have of a Fever from Fulness, where the Sides of the Vessels are distended. The Removal of the *Stricture* in one Case, is by plentiful bleeding and cooling; in the other, by relaxing the Vessels and attenuating, that the Fluids may be made to occupy a larger Space.

These Things considered we come to know, how a Fever that in the Seizure appears mild and favourable, may, when a *Delirium* comes on, be equally malignant, as that which has more acute Signs in the Beginning.

Why this Disease is so dangerous, for the same Reason that Diseases from *Inanition* are more difficult of Cure than those from Repletion.

That a *Delirium* is not to be regarded as merely a Symptom, and the Removal of it attempted by Means that in general only respects the Fever.

Hence likewise we account for a weak, low, small, contracted, irregular Pulse, shrinking of the Solids, and sudden Appearance of Wasting, when there is no increased Evacuation.

And lastly, we fix the Sense of Malignity, which should not still be left under the Scandal of being a mysterious or insignificant Term.

As I take this Fever to be very different in its Nature and Changes from other Fevers, so

it is less subject to the Rules in Prognosticks. Particular Histories should be adduced for Proof and Illustration of these Things: This might be done, but it would be too tedious.

The ordinary Evacuations in the Beginning are *Bleeding* and *Vomiting*: I do not know that *Purging* has had a Place here, nor for what Reason.

We frequently find the Patient under a seeming *Plethora*: Though we do bleed, the Symptoms are not always much abated by it; and if we bleed freely, being deceived by this Appearance of a *Plethora*, we do Harm. Indeed in general, I imagine Bleeding seldom did much Good; and if great Caution was not used, I suspect it was hurtful: But as I was not often called in the Beginning, I am unwilling to pronounce positively about it.

We are generally pretty sure what will be the Effects of Blood-letting, but we are not so with respect to Vomiting; and I am in some Doubt whether it be always useful here. In this Fever we may expect a *Delirium* pretty soon. By the Mechanism in vomiting, the Force of the Circulation is strongly determined to the Brain; which at this Time should be diverted from it, lest a thick, sify Blood impeded into the Brain, bring on a *Delirium* sooner than might otherwise happen. There is seldom great Danger, where this Symptom does not come on before the ninth Day.

Vomiting has been of a long Time useful in Fevers. It is said, that by it Nature is assisted to throw out every thing hurtful, from the Centre to the Circumference, as the Phrase is. I

do not well understand this; for however true it may be in eruptive Fevers, where Vomiting is of great Service, I do not see what it has to do, upon this Supposition, in other Fevers where we know not what is to be expelled, nor when.

In Fevers we should have a Regard to the State of the *primæ viæ*, whether or not the Cause of the Disease be lodged there. For if it should be so, by Vomiting we remove Part of this Cause, and so cut off from the Supply that might be made to the Blood. But though the *Fomes* should not be in the *primæ viæ*, we yet discharge all Superfluities, and bring those Passages into a right Condition to do their Office during the Course of the Disease, which they could not do, were they left charged with a great deal of gross Humours and Recrement. Vomiting will be proper upon another Account, as in some low Cases it gives a greater Spring to the Solids, straitens the Vessels, and keeps the Blood, where it tends to Dissolution, more compact; and so prevents its Stagnation, and hinders the Fluids from running off at a wrong Time and by wrong Outlets, as sometimes happens in profuse Sweats, Loosenesses, &c.

I only make it a Question, whether *Vomiting* be proper in Fevers *caput petentes*: For though by it the Patient may be relieved for some Time, by such an Agitation a greater Quantity of Spirits being forced; yet, if the obstructing *Lentor* be not, in a good measure, broken and dissolved, it will only be driven farther into the Vessels, or into some Series of Vessels it has

not

not reached, by which a *Delirium* must be hurried on.

Notwithstanding this, what you observed to me shall have its full Force, That Vomiting is perhaps the quickest Mean in our Power of attenuating a *Lentor*, before it be cast upon any Part. Perhaps it may do Hurt after it is impacted, by driving it farther; though it is possible, even then, it may contribute to its Attenuation, that is, Coction. I do not pretend to determine in the Affair: But we know that the Coction or Preparation of Humours, to be recirculated with the Blood, or evacuated by some common Outlet, is the Work of Nature, to be performed in a determinate Time, and under certain Conditions: And to assist her at a wrong Time, or by too forcible Means, would be to disconcert her in her more regular and safer Operations. If Vomiting is judged absolutely and constantly necessary, it should not be delayed beyond the first or second Day; for after this I think it hurtful.

But as we are to have Regard to the State of the *primæ viæ*, if Vomiting is not proper, a Purgative will perhaps answer all that is intended by it, and do something more than can be expected from a *Vomit*. When a purging Medicine is doing its Part in cleansing the *primæ viæ*, its Effect seems to reach farther. Purgatives excite some Degree of a Fever; and, from what frequently happens, we must believe that some Part of them mixes with the Blood. In Rheumatick Cases, whether acute or chronical, they are of great Service. Sydenham lays a Stress upon them in a *Peripneumonia*.

monia notha. Some Fevers in the Beginning are of no certain *Type*, which, after other Evacuations, if they were necessary, have turned out of a distinct Species, upon purging. Thus Agues are every Day brought into Form, and sometimes carried off. I know it is said, that Purgatives cure Agues, by removing the Cause in the *primæ viæ*, where some are pleased to place it: But this does not hinder the Effect of a Purgative to reach the Blood, where the Cause of the Ague may be still, notwithstanding any thing that has been said to the contrary. And I hope they will not place the Causes of some other Diseases in the first Passages, where the Effects of Purgatives are as remarkable as in Agues. Nay, some tell us, their Effect goes still farther, to cleanse the cuticular Ducts, so as to favour Eruptions: And 'tis well known that some Kinds of Eruptions inflame and turn worse, upon taking of Purgatives, I mean, during their Operation. Nor will all this appear strange, if we consider that the same Medicine, differently managed, will vomit, purge, pass off by Urine or Sweat. I need not mention that they are known to compleat an imperfect Crisis, and to promote or ascertain it, where there are no evident, or but very doubtful Signs of it.

From all this I would alledge, that, in many Cases, Purgatives are more proper in the beginning of Fevers than Vomits. For while they cleanse the Stomach and Intestines, they seem to have a peculiar Virtue to attenuate a fisy Blood: Beside that, they make a notable Revulsion from the nobler Parts, upon which
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the Force of the Disease so readily falls; and all this without that Hurry and Disturbance, so often occasioned by Vomiting. It is probable that, after Bleeding to a due Quantity when necessary, Purgatives timely given would either break the Force of the Disease, or dispose it to take some more favourable Form, as of *remittent* or *intermittent*, or perhaps destroy it. I shall not assure you of this from Practice; it requires more Time than I have had, to bring Conjectures to a Certainty.

One Thing I would not miss to take notice of here: The Distemper so mortal amongst the Cattle in this Country, is a Fever of a particular Kind. I know of no Medicine that has been of much Service, either to prevent or cure it.

The most successful Method to prevent it is, when the Cattle are thought to be infected, or the Infection near, to change the Grass, by which they are purged; and this is the ordinary Effect of new Grass. We cannot think that it is owing to the particular Qualities of the Grass as a proper Antidote, that they are preserved; Grass being much the same every where; but it must be from its purging Quality: For if this visible Effect does not follow, I'm afraid they will not escape. This suggests to us the Use of Purgatives in this Disease of the Cattle, which, amongst the many Remedies handed about, and said to do Wonders, is scarce ever thought of.

Having mentioned this Disease of the Cattle, a Comparison might be made betwixt it and some Fevers that have affected human Bodies; so far as they may be found to proceed from the

same first Cause, viz. the *Air* and *Weather*. For some Years the Seasons have not been orderly. They have been unkindly, as they say. Warm open Winters without Frost, rainy Summers and Harvests, have been generally complained of. If by these a Distemperature of the Fluids is brought on, it will be kept up, so long as the general Course of the Weather is the same. We with the Beasts are under the same external Influences from the Air and Seasons; and the same Diseases, near, will be found in human Bodies as Brutes, though somewhat different in Appearances; which is not strange, if we consider that the Beasts are constantly and more immediately exposed to these Influences, their Food being always the same, and very different from ours. Some have imagined this Disease of the Cattle to proceed from the great Swarms of Insects, of the *Clock-kind*, that come in Summer. I shall not enter into a Dispute about this. But the same external Causes that favour the Increase of these Insects, will produce the Disease amongst the Cattle, and Diseases of the same Kind amongst Men too. I have just taken Notice of this to oppose a general Mistake, of taking for Causes of Diseases, Things that are obvious to Sense, and because they have something uncommon in them; while Air and Changes of Weather are neglected, which are Causes much more powerful and constant, and certainly productive of the greatest Alterations in Bodies, though in an imperceptible Way.

But let us suppose the Disease nothing lessened, nor altered in its Shape, and now a continual

tinual Fever; I'm afraid there is a trite Way too much insisted in, in treating it, without distinguishing the Causes from whence it may proceed. You know the common Method, which I have some Time been scrupulously exact in following, without the least Variation, except where a very evident Difference of Symptoms obliged me to alter something in my Way, which yet was not perhaps very material in itself, nor well judged as to Time.

The first Thing, in the Method of Cure, I take notice of, is *Blistering*. As soon as a *Fever* is known to be of the *nervous* Kind, a *Blister* is laid to the Back, then to the Arms, next to the Legs, last of all to the Head, and at the same time Cataplasms are applied to the Feet: Which last I have seen so ill-timed, that they have been but an Hour or two applied, when the Patient, after long Watching and Raving, has seemed to fall asleep, but never awaked again. All this appears very methodical. And every one is now so well acquainted with *Blisters*, that every body knows when they are to be applied, how many at a Time, to what Places, and which is, by Custom, to have the Preference of being blistered first. So that he who will blister, or do any thing else out of the Fashion is hardy indeed, and runs no small Risk.

I am perswaded that Mistakes are frequently committed, both as to the Times of Application and the Places to which *Blisters* are applied. This *Fever* I have observed to be attended with a *muscular Tension* or *universal Spasm*; and this owing to a *Lentor* in the Blood, having

having more or less Tendency to Inflammation. Blisters are absolutely necessary to attenuate this *Lentor*, and the good Success of them every Day, convinces us of their Efficacy this Way: But then they very much increase the *Spasm* that attends the Fever, especially if applied to Parts more irritable, as Back and Arms. I have been much disappointed, and at my Wit's end what to do; when Blistering, which I most trusted to has heightned all the Symptoms; and this was most observable from the Pulse, which, in the Intervals betwixt the different Blisterings, was pretty full and soft, upon every new Application becoming smaller and more contracted, other bad Symptoms increasing in Proportion. This Contractedness of the Pulse I could attribute to nothing but a *general Spasm*, from a *Stimulus* applied to a nervous Part, as is the Skin, which by Consent will bring every Part of the Body, capable of it, into a State of Contraction; and this is a Property every particular Fibre is endued with.

To increase the contractile Power of the Vessels, is, in some Cases, a very good Intention, whereby to attenuate the Viscidity of the Blood; and that is, where the Vessels are relaxed beyond their just Dimensions. But, in the present Case, the Vessels seem to be too much contracted, perhaps within their natural Diameters; and to increase their Force now, would be to render yet more compact their fizy Contents: Which possibly might be dissolved and rendred fit for Circulation, were the *Stricture* of the Solids taken off, and Room given to the Particles of the Blood, now strongly in Contact,

Contact, to secede from one another ; proper Attenuants of the Blood and Diluents being given to assist herein.

Blisters are likewise hurtful, as they draw off a great Quantity of *Serum*, and leave the Blood thicker. 'Tis true, the good Effect of a Blister in attenuating the Blood, may make Amendments for all the Loss of *Serum* by the blistered Part. But I mention this Inconveniency, because I think Blisters are not always intended to evacuate. And we should be very careful not to make any considerable Drain of *Serum* from the Blood ; because it is so necessary for the Dilution of its thicker Parts, and so hinders Obstructions from being formed. But, which is worse, the Loss of *Serum* by *Blisters*, is the same as taking away the same Quantity of Blood, which the Patient is not in a Condition to bear.

I know it is absolutely necessary to do something, the soonest we can, in *Fevers*, that we may be before-hand with the Disease ; for an Opportunity lost at first may not afterwards offer. And from what I have been saying, you must not think that I am against the Use of Blisters ; but I would gladly fall upon such a Way of applying them, as they shall answer all that is proposed by them, without the Hazard and Inconveniency that attends the Application of them the ordinary Way. If I durst propose a Method, it would be this :

Upon the first Appearance of the Head being affected, as when the Urine turns pale, when they sigh and have great Anxiety, are deaf, or the Eyes sparkle, or look staring, &c. I would have

have a Blister applied to the whole Head. This I have seldom seen done, till the *Delirium* was come to a great Height, and seemed then to be done, as a Push for the Patient's Life, when indeed it is more likely it did Mischief; but might have done great Good, had it been applied sooner.

We have Instances where, by blistering the Head, giving the strongest Alexipharmicks, and every thing that could quicken Nature, the mortal Symptoms have been commanded after they were come on. But I am apt to think, that this happened in very low Cases, where the strongest Spur was necessary, and could do no Harm. And singular Instances should not determine us to stick close to a Method, as if the first Symptoms of a *Delirium* were too inconsiderable to require this *Herculean* Remedy, but the Symptoms are suffered to go on to their greatest Height before it is applied, lest we should be thought to do too much where less might have done. Besides this very bad Reason, if ever used, the Appearance it has of Severity makes People afraid. But blistering the Head does not put such a Force upon Nature as is thought, nay not so much as blistering other Parts. A Blister on the Head gives far less Pain than when applied to any other Part; which shews that this Part is less irritable, and consequently all the bad Effects from too great Irritation will be prevented; which I said before, were an Increase of the *Spasm*, and a further *Stricture* of the Vessels. A Blister betwixt the Shoulders has been known to bring on a *Delirium*, which has not gone off till the Blister was

was removed. This could be occasioned by nothing but the Irritation.

When a *Delirium* comes on, there is then a beginning Obstruction of the Brain. By applying a Blister to the Head, we endeavour to attenuate and dislodge this Obstruction; which we have a good Chance to do, while it is but small, and the Vessels have not lost their Action by being over-distended. If we can resolve the Obstruction at this Time, the same Cause that resolved it will also stimulate the Vessels, and give them a Firmness able to resist the Viscidity being forced into them any more. Besides, the Blood will be more determined to flow by the external Carotids, by which the Pressure will be considerably taken off the Brain. And will not a *Stimulus* affecting the Muscles and Membranes of the Head externally, accelerate the Blood's Motion in the external Jugulars, and so give some Relief to the Brain this Way? Those acquainted with the Anatomy of this Part, will easily find how Blistering answers the Purposes both of *Revulsion* and *Derivation*; and how the active Parts of *Cantharides* may pass into the Brain, so as to reach the smallest Vessels that are obstructed.

Wherever there is an Obstruction we incline to make our Applications as near the affected Part as we can. By blistering the Back then in a *Delirium*, we fail in this Rule, this Part being very remote from the Seat of the Obstruction; and all the Good that it is obtained, is by attenuating the Blood in general: When in the other Way, the whole Force of the Blister is immediately exerted upon the Part obstructed.

But

But let us suppose the Head not to be blistered till late in the Disease, when the Obstruction is great, or the Vessels of the Brain being over-distended, have lost the Power to recover themselves; the violent *Stimulus* will tear and destroy these delicate Vessels; or the Matter will be farther impacted into the Brain, and the Obstruction rendered irresolvable: And if these Vessels have lost their *Elater*, from an Over-distension, we do nothing at all. It is for these Reasons, I fancy, that we are forbid to blister the Head when the Eyes are inflamed, which is a Sign there is considerable Inflammation of the Brain too; and if we dare not blister in this Case, the only Time we have left us to do it in, is while the Obstruction is forming, or at most has occupied but a small Number of Vessels.

I shall not mention the good Success of blistering the Head in some Cases where it might have been doubtful, other Things having been administered. But it was remarkable in a young Man, ill, as was thought, of a Rheumatick Fever: A *Delirium* came on very soon; a Blister was applied to the Head, and, a few Hours after, it went off. The Surgeon coming next Day, took off the Blister, and very soon the *Delirium* returned. The Blister was again applied, and with the same Success as before. It was from this Instance, and observing Symptoms to increase upon blistering other Parts, that I took the Hint to blister the Head first in a *Delirium*; and having tried it several Times since, I flatter myself that I was not disappointed.

When a Blister is applied to the Head, it iss

to be minded that it must be kept on three or four Days, because it will not do its Office, to any Purpose, in a shorter Time. This is another Reason for applying it soon, that it may have some Effect, before the *Delirium* comes to a Height, or has continued above three Days.

I do not imagine that *blistering the Head* will prevent, or always carry off a begun *Delirium*. It is seldom we are so lucky in any Case, and I do not wonder to see the *Delirium* come to a considerable Height, notwithstanding this Precaution. But if by it we can so dispose the Vessels of the Brain, or the obstructing Matter in them, as that the Obstruction shall be resolved in a proper Time, which happens when the *Delirium* does not continue above four Days, then I think we do a great deal.

While we are thus endeavouring by blistering the Head, to resolve a beginning Obstruction, and render the Brain someway able to resist being farther obstructed, the Legs should be blistered, that the Force of the Circulation may be determined downwards, and the Head relieved. I once imagined, that Blisters at the Legs gave little Pain, having had some Instances where the Patient made but little Complaint of them: But I am now convinced they are the most painful of all Blisters. It does not seem agreeable to the Scheme I am proposing, to blister the Legs; because of the great Pain and Irritation, and Loss of *Serum* that happens by it, and which I alledge should be prevented. I own there is a Difficulty here, and every thing
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has its Advantages and Disadvantages. Though there is a considerable Loss of *Serum* by blistering the Legs, a Discharge may be more safely promoted here than from any other Part; it strongly diverts the Humours from the Head. The Sense of Irritation will be much abated by the frequent bathing of the Legs, which may be done some Time before the Blisters are applied. The Hair should be shaved off the Legs, because of the exquisite Pain the pulling of it occasions in dressing the Blisters.

The Feet and Legs should be warm-bathed two or three times a-day. By this not only the Parts to which the Bath is immediately applied will be relaxed, which will a good deal allay the *Spasm* through the whole Body; but a great many aqueous Particles will get into the Blood, which, mixing with it in the extremest Vessels, will cool and attenuate, and be more effectual than drinking plentifully, to dilute it. Such Things may be put into the Bath as will best answer these Ends.

Your Observation comes in very properly, as a Caution not to be too free in bathing the Feet, however harmless it appears to be: I was not aware of the Danger of it, which makes me now the more pleased with what you say of it. In *nervous* Fevers a *Delirium* is sometimes hurried on, and much Hurt done by a *Pediluvium*. The Mischief it does seems to be owing to the withdrawing too much from the Head. As they cannot bear bleeding, but faint from Lowness; so neither can they bear the simple Revulsion, by putting the Feet in warm Water, with the Head elevated, (as is common,

mon, to get them into the Water) without fainting, raving, and bad nervous Symptoms.

Acrid Cataplasms applied to the Feet at this Time, might divert from the Head; but they stimulate too much, and so increase the *Spasm*, giving as much Pain for ordinary as Blistering, and the Patient is thrown into a Rage by them. I cannot conceive of what Benefit they can be when applied the third or fourth Day of the *Delirium*, being in no Sense suitable in that State of the Disease. And instead of acrid Cataplasms, those of an Anodyne relaxing Virtue, and that some way attenuate the Blood, are more proper; such as, *Capita papaveris*, *Sal ammoniacum*, *Stercus bovinum*.

Epithems will be of good Service here, and the best I know is one you mentioned to me of *Wine*, *Camphire*, and *Acetum rosatum*. This applied to the Temples and Forehead, Armpits, Wrists, and other nervous and glandular Parts, will very much soothe and allay the *Spasm*; and being grateful to the Smell, and penetrating, will refresh, attenuate and resolve. Something answering the same Intention, may be frequently smelled at, and snuffed up into the Nose.

If by blistering in this Manner, and other Assurances, we can hinder a *Delirium* to come on, or so provide against it when it does come on, as there shall not be a confirmed Obstruction; we may then proceed to blister other Parts as the Disease shall require: Nor need we fear that the Irritation, or a large Evacuation, which sometimes happens, will be so hurtful now as they would have been sooner.

You'll certainly be thinking by this Time, that I have said enough about increasing a *Spasm*, and Loss of *Serum* by Blistering. I have observed that this Fever was attended with a notable *Orgasm*, so great, that upon every little Disturbance or Irritation, the Patient was thrown into Heats, Anxiety and Disorder, which necessarily increased the *Delirium*. It is of the greatest Advantage to Patients, that they be kept in a dark Room, free from Noise, or any thing that may disturb them: And if we are thus careful, by a proper *Regimen*, to procure them Quiet; ought we not to be as much so in all the Applications we make to them? If we are not, it is just like one with sore Eyes, who finds great Relief, by having them covered from the Light, but has a Candle held to his Skin till he is burnt; though he be free of Pain one Way, he feels the Smart another. All the Quiet one may enjoy in Darkness, Silence, and by other good Management, is soon at an End, when Nature is fretted by the painful *Stimulus* of a Blister. This way of Reasoning will seem to bar the Way to Blistering altogether, because Pain and Irritation are inseparable from it. But I think I have shewn how they may be in a good measure prevented; and it will not be alledged, that Blisters are useful only as they stimulate and give Pain. I have said before, that they are not always intended to evacuate; and I say now, that they would do more Good in many Cases, if they do not irritate at all, or but very little: In our Fever I cannot allow that they are otherwise useful than by attenuating the sify Blood, which they do powerfully,

powerfully, by Means of a volatile alkaline Salt. So that the Consequences of Blistering, a painful *Stimulus*, and great Evacuation, ought as much as possible to be prevented. In other Cases, where there is great Laxity and Dissolution of the Blood, they will be useful, both as they are a brisk *Stimulus*, and promote a plentiful Discharge of acrid or superfluous Serum.

I do not know whether it be for Fear of increasing this Spasm, or making too sudden a Drain of Serum from the Blood, or both, that we are advised by some to apply but a few Blisters at a Time, and to make as great Distance of Time betwixt the Applications of them as the Case will allow; but then they must be kept running a good while. This Way of turning the Blisters into Issues will have a very good Effect, as it makes a moderate Discharge from the Blood, as it determines the Circulation to some particular Parts, and by a gentle continued *Stimulus* keeps it up, and prevents Stagnations in the *Viscera* and Organs. I have observed it to do very well when the Fever runs out beyond the fourteenth Day, and the Patient through Weakness, or that a sensible Crisis has not given a Turn to the Disease, still labours under it, and the Event is doubtful. The only Hope we have sometimes is, that Things are at a Stand, and the Symptoms do not increase. In this Case I am always loth to harass Nature by a new Application of Blisters, lest the Strength should sink. But if she be well managed, she will at last do the Business. For I judge the Disease is for most part at a Height, the Time

I mentioned (they seldom dy when they get over the fourteenth Day) and must decrease, though slowly: And all that seems necessary to be done is to keep the Blisters running, to give such Things as may insensibly waste the Disease, as Diaphoreticks and gentle Purgatives, (I give small Doses of *Pil. Rufi*, and frequently;) not forgetting to nourish according to the Strength, and to give proper Cordials, lest they languish into a *Hectick*, and go off that Way. This *Hectick* is of the intermittent Kind, partly from *Inanition*, partly from the Matter of the Fever not fully carried off. Blistering can be of no Service, and the Success of the *Cortex* I very much doubt of.

Blistering is reckoned useful, as it determines the Circulation to the outward Parts, and so preventing internal Obstruction and Inflammation. I agree to it, but not in the Case of a *Spasm*; which indeed is the Reason that the Blood is forced from without inwards, upon these Parts where there is the least Resistance.

It sometimes happens that the Patient is fatigued with continual or partial *Sweats*, and the Loss of the more watery Parts of the Blood, so necessary to cool and dilute it, ought carefully to be prevented. These Sweats are symptomatical only, and give no Relief, but frequently the Sick grow worse upon them: And they are owing to a *Stricture* upon the Vessels, by which the watery Parts are expressed and poured out by the Skin; which is relaxed, and easily allows the expressed *Serum* to pass through, for want of a due Secretion of Spirits from a thick Blood, or that this fizy Blood can-

not

not be circulated into its Vessels, to give it a Tightness. That there is but a small Force of Circulation towards the Surface, appears from the Degree of Heat felt upon the Skin, which is seldom more than natural. I have seen a Blister stopping these Sweats, no doubt by giving a greater Firmness to the Skin. But as I make a Scruple to apply a Blister too soon, unless to the Head, because it increases the *Stricture*; some other Method may be tried to prevent the Sweats, causing the Patient to sit up in Bed, if he is able, and ordering the Bed-cloaths in a proper manner.

There is one Thing more I would observe, it is with respect to the Time in which Blisters ought to be applied; which ought never to be in the Access of a Fever. The Disease has generally *Exacerbations* towards Night, which is the ordinary Time of applying them. I am sure a Blister of itself raises no small Degree of a Fever: Now betwixt this and the Paroxysm of a Fever already upon him, we cannot but pity the poor Patient, who must undergo a pretty severe Trial. But this would be little minded, if the Disease were not really increased by it. For if in the Access of a Fever, which we would gladly prevent if we could, Nature is under a violent *Spasm*; it would seem needless to put a greater Force upon her, by a super-added *Stimulus*. The fittest Time then to apply Blisters is, when there is the greatest Absence of the Fever. And indeed the Management of Blisters in this Fever, and from the Cause I have all along supposed, is not so easy as is thought. To apply them at such Times, and

to such Places as most favours Nature, to obtain all that we wish for from them, and do no harm by them, when we intend by them to do the greatest Good; to do all this, I say, will require some little Niceness.

In Paroxysms of Fevers we are not at Liberty to give the *Cortex*, nor in convulsive Cases, which are always attended with Pain and Tension. This Medicine, if given in the Fits of these Diseases, while Nature is under a violent *Spasm*, might, by its great *Stimulus* or astringent Quality, so straiten the Vessels as to occasion a Strangulation in them; so that however useful it may be out of the Fit, we find by Experience that it is hurtful and dangerous in it. The same may be said of all these Things which act by a strong *Stimulus*, which we are careful not to apply in the Access of Fevers, but rather such Things as soothe and relax, and, in short, have an Effect quite opposite to that of a *Stimulus*. And thus I have told you my Opinion about Blistering, and the Time and Manner in which I would have it done: You see I have only taken the Liberty to invert the Order, doing that first which is generally deferred to the last. When I reason upon the Nature of an Obstruction, together with the Time and Methods proper for Resolution, I cannot think but this way of Blistering is more agreeable to the Notion we have of these Things than that which is commonly followed.

But Blistering will not of it self do all. I have supposed, as the Cause of the Fever, a *Lentor* of the Blood, and a *Spasm* consequent of it; and these depend so much each upon the other,

that

that without some Caution we may, providing against the one, easily increase the other. The Intention of Cure then will be double, to attenuate the *Viscidity*, and allay the *Spasm*. Blistering is very well fitted to answer the first, but with this Inconveniency, that it increases the other, unless managed in some such Manner as I have hinted; and at the same time Medicines be given that may answer the other Intention, or both.

Common Practice bids us, without making proper Distinction, give warm, generous Medicines, Alexipharmicks, and all of that Tribe that heats, stimulates and forces Sweat. But if what I have said about Blistering be true, we will see that Medicines of this Kind are ill-suited to the Nature of this Disease, at least in many Cases. For these Things that stimulate, and so increase the Circulation, will but farther increase the Spasm and Obstruction. And if Sweats are forced, this will render the sify Blood still thicker, and less fit for Circulation.

It will be said however, that this Fever is attended but with a small Degree of Inflammation, and little Increase of the Circulation; which seems to indicate Medicines of the warm Kind. This at first View will appear true; but I am convinced from Experience, that Nature is here as much affected with a *Spasm*, as in some Cases where there is greater Inflammation; and that this *Spasm* would not produce the bad Effects it does, if Nature were not forced on by indiscreet Methods, to exert herself in the Cure of the Disease more than is necessary. The many Instances of Recovery amongst

mongst the poorer Sort, who have little Attendance and less Medicine, may be a Proof of this. The Lowness of the Pulse, Fainting and moderate Heat, impose upon us, making us believe that the Blood is poor or defective, or that there is something of Malignity, (which is not very well understood) and that upon these Accounts the vital Functions are not performed: And upon this Supposition, the Indication is taken for warm stimulating Medicines. But it may be easily made to appear, I think, that these Symptoms proceed from a very different Cause, viz. a *Lentor* of the Blood, and a *Spasm* depending upon it; which is the Reason that there is a less Secretion of Spirits for the Use of the several Organs, and a more difficult Circulation through the whole System of Vessels. From the same Causes in other Diseases we observe the same Effects. This is plain in the Case of *Vapours*, or *hysterick Fits*, which most frequently are thought to proceed from a Viscidity of the Fluids, and such a Constitution of the Solids, as I choose to call a *genus irritabile*. A rational Practice has found, that in this Distemper, I mean in the Fits of it, warm, stimulating, or highly attenuating Things, given with a Design to raise the Spirits, are not the safest.

But the Connexion betwixt *Vapours* and a *Fever* will not be easily perceived; nor is it necessary, in Reasonings of this Kind, that Things should answer so exactly in all Circumstances. I shall own my Want of Invention, in not being able to contrive a different Cause for every different Disease that may fall in the Way; but I endeavour

endeavour to pursue the same Cause through as many Distempers, and Degrees of a Distemper, as can be done with any Probability: Though in all Appearance the Difference is very great betwixt an acute and a chronical Disease; perhaps it will not be found so, when the Thing is more nearly considered. For do we not see acute Diseases ending in chronical, when the *materia febrilis* is not fully exterminated? There seems to be no other Difference, but that the Cause not existing in the same Degree or Force, cannot produce suddenly a Train of violent Symptoms, as it did, when, in a greater Degree, it was the Cause of a Fever. On the other hand, many chronical Diseases are not cured, but by a supervening acute one. Thus *Palsies*, *Epilepsies*, and several other Diseases we have no Name for, have been carried off by a Fever continual or *intermittent*. Now whether is this Fever accidental, and in its Cause different from that of the former Disease; or is it the same Cause increased, or acquiring some new Quality, so as to be able to excite a Fever? The more obstinate chronical Diseases are said to have been cured by a *Quartan*. I shall therefore, with Leave, call this the *Mid-way* betwixt acute and chronical, unless a *Quintan* or *Sextan* be more properly so; but these rarely happen. In chronical Diseases the Cause of them seems to be seated in the smaller Vessels, and has not such Properties as to produce any Effect in the larger Vessels, which I take to be the Scene of Fevers. But if this Matter, from its Nature, or a Course of external Causes, changes its Seat, and in the larger

larger Vessels forms larger *Moleculæ*, acquires new Qualities, and is put into Motion, we may conceive how at length it will produce a Fever: And proportionally to the Degrees of Increase, it will at first, leaving the Form of a chonical Disease, appear in an acute Form of the longest Period, and so on till it becomes a Fever without Periods, or continual. When I have said this, it will look strange if I say again, that the Accesses or Fits of chonical Diseases, many of which are periodical, some regularly, some irregularly, are Efforts of Nature, to put on an acute Form: And when all our Art has been baffled in the Cure of them, we have been glad to leave them to the Chance of an acute Dis-temper, by which they may be carried off. Though I say that this Change of a chonical Disease into acute, is owing to an Increase of the Cause, I do not mean it as bad; for this Increase is a gradual Tendency of the Matter to Coction, to be assimilated again to the Mass of Fluids, or wholly expelled the Body.

Nor with respect to the Cure of both are the Intentions different. The most general are, to evacuate or suppress an Evacuation; to attenuate the Blood, or preserve its Consistency; to resolve an Obstruction; to correct Acrimony; to restrain the irregular and increased Motion of the Fluids, or raise it when too languid. All these Ends are obtained by the same Means. The only Difference then is this: In acute Cases, the Disease finishes its Course in a short Time; the Symptoms during this Time are all upon the Patient at once, and very urgent. The Matter of the Fever is either very moveable,

able, and so may easily be thrown upon some Part necessary for Life; or it is firmly inherent in the Vessels, and by a too forcible Trial to remove it, may form a mortal Obstruction. This obliges us to be cautious both in the Choice and Application of Medicines, and very observant of the Times that are most proper for such Application. On the other hand it is easy to see, that in chronical Diseases we are more at Liberty, and may sometimes make a bold Attempt for the Patient's Recovery; nor need we be so exact, either in the Choice of Remedies, or in the Time and Manner of applying them. It would be taking up your Time too much, to advance all that might be said upon this Head, the Design of which is to shew, that we shou'd not put such a Difference betwixt acute and chronical Diseases, as not to admit of Reasoning from the one to the other, or think that the Methods of Cure are as opposite as some imagine the Causes of them to be. I do not think I am straining the Thing, when I plead the Practice in some nervous chronical Distempers, as an Argument for the same Practice in this Fever; which, because of the near Resemblance it has, in many Things, to these Diseases, is properly enough called *nervous* too.

The Medicines I would choose, as best suited to the Disease, are such as do not stimulate, or but very little, nor increase Inflammation: *Oculi & chelæ cancrorum*, *Sperma ceti*, *Rad. serpentariae Virg.* *Valerianæ sylv.* *Castoreum*, *Sal prunellæ*, *Sal absinthii*, *Sp. nitri dulcis*, *Sp. salinus aromat.* *Sp. cornu cerv.* and the like. *Antimonium diaphoret.* is highly commended by

some in a *Delirium*. *Saffron* in small Quantity is anodyne. If we examine into these, the most of them will be found to enter into the Composition of the most celebrated antispasmodick Remedies. As some of them allay the *Spasm*, others attenuate the Blood; both which contribute to keep up a free Perspiration, which is always a good Sign, forced or continual Sweats being generally hurtful. They may be mixed and proportioned as there is greater or less Tendency to Inflammation. They may be given with more Advantage in small Doses, and every Hour or two, than every fourth or sixth Hour, as is commonly done; when the Dose being larger, the Patient finds himself heated, sweats and is uneasy: Whereas by giving them in small Doses and frequently, we put no Force upon Nature, and have a constant, equal and gentle Effect from the Medicine. They may be given conveniently in a Julep made up of cordial and analeptick Waters, as they are called, which may be drank at Pleasure, and will not fail to give Relief under Lowness and Oppression. We are not, upon every Change or Appearance of a Symptom, to stop the giving of these Things, or give more forcible Medicines upon an Increase of Symptoms. These persisted in, even when they seem to be doing but small Service, will perhaps in the Event answer our Expectation; for it is not the giving of a Medicine for a Day or two that will do the Business; they are very unreasonable who look for any considerable Effects from such slight Administrations. I should have mentioned *Camphire*, which has

this great Advantage, that it may be given in any Case of this Kind, without Fear of increasing Inflammation; and whether the Case have more or less of it, it is very proper, and may be conveniently joined with other Medicines, whether intended to warm or cool. *Cumphire* is really an Antispasmodick, as by immediately affecting the Solids, it procures a Relaxation of them when too much contracted. How it becomes useful in hysterick and maniack Cases, as a *Diaphoretick*, *Antaphrofyniack*, &c. may be accounted for from this. The particular Manner of its Operation will be understood from what shall be said, when I speak of the Use of Wine in Fevers.

It is well known that Dilution has a large Share in the Cure of Fevers, and Drink must be given plentifully, not only as a Vehicle to convey Medicines into the Blood, but as it cools, attenuates, relaxes and keeps up the liquid Secretions in a natural Order. Lenient, aperient Decoctions, somewhat saponaceous, are best suited to the present Case. These, as they are easily miscible with the Blood, do not run off so soon as Drinks that are thinner, or vinous, and force Sweat, which is not to be encouraged beyond a Moisture. Though Sack-whey is the common Drink, and very good, I sometimes prefer common Whey. When I do not, or but seldom, favour a Drink that has Wine in it, you'll readily guess that I forbid all ardent Spirits, as they stimulate too much, and may in some Degree coagulate the Blood. Nor do I see that spirituous Juleps are proper either as Vehicles, or to be taken when faintish:

When I allow any thing by way of Cordial, it is two or three Spoonfuls of *Malaga* or *Sack* by itself, more or less as the Case requires. These Wines being stocked with a rich Oil, when applied to the Vessels, adhere, and give a kindly Heat and gentle *Stimulus*. When they are drank to any Quantity, they do more Harm than the lighter and more sprightly Wines; but taken in the smallest Quantity, are a much better Cordial, and are preferable to ardent Spirits, which indeed have a sudden Effect, but of no Continuance. Those who have used any Freedom in drinking these Liquors, will know the Difference.

The Necessity and Usefulness of Wine, together with the Manner of its Operation, will appear from what follows. It is a known Property of Heat, that it lessens the Power of Cohesion in all Bodies, and in a proportionate Degree destroys it in the hardest. This Power of Cohesion in different Bodies, when we consider the Manner of it, is Matter of curious Speculation. But it is wonderfully adapted to usefull Purposes in the flexible Canals of animal Bodies, which can be straitned or relaxed from various Accidents, and as the Occasions of Nature may require. The Effect of Heat upon the human Body is sufficiently felt in hot Weather; when all the Solids are relaxed, even to Weakness and Loss of Spirits. In the first Attacks of acute Diseases, attended with *Horror* and *Rigor*, or the cold Fits of an Ague, the Patient strives to divert the uneasy Sensation of Cold and the Struggle and Pain he is in, by drinking something warm, or sitting over the Fire;

Fire; which gives some Relief for the Time: And the best Way to prevent the Severity of these Coldnesses, is to put him to Bed, and give plentifully of diluting, aperient Liquors, warm. If then a certain Portion of elementary Fire, applied outwardly, gives so much Relief, any thing that will have the same Effect, and applied to the Insides of the Vessels, promises to answer the End much better, of procuring an agreeable Relaxation to the Solids, under that State of Rigidity they are in, when affected with a *Spasm*. This Effect I suppose Wine will have, if given discreetly.

Three Sorts of Medicines operate in this Manner, and differ only as this warming penetrating Oil is more or less involved. These are *Camphire*, *Wine* and *natural Balsams* with their Oils. I had almost placed *Opium* at the Head of them, but I was afraid of a Debate. *Camphire* is extremely volatile, having nothing of Phlegm, Glütén, or impurer Oil to hinder it from flying off. Its Volatility renders it in some Cases more useful than Wine, particularly in Inflammations, where, did this Oil adhere to the Vessels a long Time, it would increase it. But for this Reason, it is less useful in other Cafes than Wine, which applied to the Vessels, adheres more firmly, and so has a more lasting Effect, which seems necessary in Fevers, where the Inflammation is small, and the *Tension* great. These Things, beside relaxing the Solids by their kindly Heat, (which some, fond of Words, would call *congenial*) they likewise attenuate the Fluids, and blunt the Acrimony, and so remove the Causes of

Tension and *Inflammation*. Natural Balsams are more fit for external Application, their Thickness, and too great Cohesion rendring them unfit, in Cases where the other are proper. When they are given internally, it is chiefly with a Design to deterge, prevent Putrefaction, and increase Heat, where it is below the Standard. *Oil of Turpentine* applied externally to the Spine, before the Fit of a *Quartan*, is said to have been a Cure. I cannot account for this, but from the Heat it occasions. This Heat diffuses an agreeable Warmth through the whole Body, by which the *Tension* is taken off, and the Resistance which was given to the Blood's Motion; which now flows easily into the extremest Vessels.

I commonly give a small Glass of Wine five or six Times a-day, and never observed any bad Effect from it. I have known it taken to a much greater Quantity for several Days, beside a reasonable Quantity of common Julep, which contributed not a little, I believe, to the Patient's Recovery. I do not think, however, that Wine is to be given at all Times of the Disease, particularly in the Beginning, when the inflammatory Symptoms are any thing considerable, but for several Days before the Height, it may be given with great Advantage, as well as after it.

I sometimes meet with Opposition in thus prescribing Wine. The very Mention of Wine in Fevers, and where there is a *Delirium* too, is apt to give People bad Impressions of Rashness or Want of Skill. And because such will not receive any Thing they are not used to,
without

without the Sanction of Antiquity or great Experience, I can tell them, that this Practice of giving Wine, sometimes in acute Cases, has the grave Authority of *Hippocrates* to support it.

Wine promises to be still more useful where the Blood is poor and much dissolved, in which Case it naturally acquires some Kind of Acrimony. For it will restore the relaxed Vessels to their former *Tone*, invigorate the Blood's Texture and Motion, by storing it with warm balsamick Parts, exhale the vapid *Serum*, resist Putrefaction, and correct the Acrimony. Upon all which Accounts it becomes a sovereign Remedy, in all Fevers of this Kind, that have not a greater Degree of Inflammation in them, and in some particular Kinds of *Small-Pox*, there does not seem to be a better, provided it be given in a right Manner and sufficient Quantity.

When the Patient is faint and oppressed, wearied and anxious, we are obliged to prescribe something by way of Cordial, when perhaps the Case will not allow of any Thing that is heating. I am of Opinion, that the best Way to procure Relief under such Lownesses and Oppressions, would be by gentle Anodynes. These, as they allay the *Spasm*, would give greater Freedom to the Blood in its Motion, and have some Effect to attenuate it, and so would answer the Intention of a Cordial much better than what is commonly given, and which acts no other Way than as a *Stimulus*. When the Disease seizes with greater Signs of Acuteness or Inflammation, as Vomiting, looseness,

ness, Heat, Thirst, Sighing and strong Depression, (as this Hurry of seemingly inflammatory Symptoms is more or less, so will the Faintness and Anxiety be:) When this is the Case, I say, a gentle Opiate, given in some refreshing Julep, will have a happy Effect to alay these overbearing Symptoms. These Symptoms then happen only the first Days; for by the Time the Patient is delirious, they are pretty much gone, or he is not sensible of them: This is the proper Time to try Opiates, lest by the Urgency of such Symptoms greater be brought on. A prudent Use of them might hinder a *Delirium* from coming so soon as otherwise would happen. This would be no small Advantage, for the Patient's Life depends upon the *Delirium* its coming sooner or later. When the Seizure is with moderate Symptoms, there is little Occasion for them, till the Disease is further advanced, and a *Delirium* comes on with Watching, Raving, and a dreadful Train of nervous spasmodic Symptoms, which will not be commanded by a less powerful Remedy than *Opium*.

But perhaps it will be thought, that there is yet no great Necessity for Opiates, as no considerable Symptom has appeared to require them. If the Symptoms depended upon any other Cause than that I mentioned, I should think so too. I still insist upon it, that there is in this Fever a violent *Tension* of the Solids, even when we cannot be sensible of it from more evident Appearances. And of how much Advantage it would be to soothe and compose Nature, under this *Tension* and Proneness to be

be irritated, one may very easily conceive. The known Effects of Opiates, their being without Danger when rightly managed, and their great Usefulness, in Cases so like to this I am speaking of, should encourage us to try them here too. We are informed by some Authors of the incredible Success of Opiates in *Fever*s of a bad Kind. You have told me, that an expected *Crisis* may be safely promoted by giving an Opiate; this I suppose is when there is some Fear that Nature may fail, if not well assisted in it. This has a great deal of Reason in it, and it cannot be useful this Way, but as it allays the violent Spasm, and frees Nature from the wild Hurry and Struggle she must be in, in the Instant of a *Crisis*: And by this means all Impediments being taken away, the Humours already concocted and fitted for Separation, fall off of themselves almost, by some common Outlet, fitted according to the exact Laws of the Oeconomy, to receive them. Dr. Boerhaave (*a*) has an *Antipyreticon*, which in Agues he calls *raro fallens*. From my own Trial of it, I know that it will prevent the Fit for the Time, and if it does not remove the Disease, it paves the Way for more successfully exhibiting the *Cortex*, which is given frequently without Effect. As the great Stress must be laid upon the large Dose of Opium in it, this may be referred to what is said. In hysterick Cases, we can do little without Opiates to allay these sudden and violent Affections of the Body in that Disease, which I have frequently observed to grow

(a) *Libello de mater. medic.* § 761.

grow worse upon the smallest Irritation. In convulsive Disorders I think they might be more frequently used, and with more Success than what is common. All Things administered here, externally as well as internally, are warm, stimulating, spirituous and aromatic, and therefore are said to be good and comforting for the Head. I am very certain the Symptoms are frequently increased by these: But I have seen Bathing from the Middle down, dry Cupping, and whatever will make Revulsion, without Loss or Irritation, and these Things allay a Spasm by their Anodyne Quality, (properly) have a surprizing Effect, to procure a Remission of the Fit, when the most noted *Cephalics* have been hurtful or useless.

In advising the Use of Opiates, I shall be very much under Correction; and believe that it is only in some Cases of Fevers they can be given with Safety and Advantage. Where there is any considerable Degree of Inflammation, they are thought to be hurtful, especially if there be Obstruction of a particular Part: Yet the *Papaveracea* are given here. And where there is great Relaxation and Dissolution of the Blood, they are plainly out of the Question. It is in a mixed Kind of Fever that they can be useful, such as ours was, where there were Degrees of Inflammation, but that would not admit of the Methods of Cure in Inflammation, and had in it beside a remarkable *Spasm*. I know it will be taken for a putrid Fever of the Rheumatick Kind I have been speaking of: But there was considerable Difference in many Things from that Fever as we have it described:

bed: And therefore I have retained the common Name of *Nervous*, being more careful to explain the Disease as it is in itself, than fix it to a particular Class: *Putrid* is a Term, which, till defined, gives me no Idea of the Nature of it.

I do not think *Opiates* are to be given to any considerable Degree, but in such a Manner, that though their Effect can hardly be observed, we may be sure they have some. And by mixing them with other Things, we may prevent their bad Consequences, so often observed and justly feared. The bad Effects of Opiates are not from their being absolutely hurtful in themselves. There is a great deal in the Time, the Manner, the Dose in which they are given; not to speak of the Patient or the Disease. Were these Circumstances duly minded, Opiates might be applied successfully to many more Purposes, than they have yet been. I have known an *Asthma* increased by what was only thought a reasonable Dose of *Opium*: But the same Quantity, or a little more, given at Times, in such Manner as the whole should not be consumed in less than twelve Hours, has had the desired Effect, and the Patient has been greatly relieved. Frequently we are obliged to give an Opiate in the Morning, the Effect of which is not wanted till Night, for some are wakeful after taking it.

I am favoured in the Opinion of Opiates being useful in this Feyer, from the Contrivance of a Medicine now pretty much in Use, the Tincture and Decoction of *Serpentaria* of the Edinburgh Dispensatory, which are gently sudorific

dorific and anodyne. The Tincture is certainly a fine Medicine, and the only Objection is, that it will be too warm in some Cases, and that the *Opium* is there joined to the other Ingredients, and must be always given, whether necessary or not. I still like to have it in my own Hand.

And now, to put an End to a long Letter, you will easily find from whom several Hints and Observations here are taken: Any thing of my own will be as easily discovered, as having less to support it, perhaps. I have taken the Pains, however to bring these Things into one View, and endeavoured to accommodate them to a general Scheme; in which I have kept as close by Nature as I was able, having had all along a strict Regard to the Genius of this Distemper. There is a great deal more to do upon the Subject: I have only attempted to set one Kind of the Fever in a clearer Light. I wish much to see some, whose greater Judgment and Practice might better enable them, undertaking something more full and distinct upon it, than we have yet been favoured with.

XXIV. Remarks on the Cure of Agues; by Dr. ALEXANDER THOMSON, Physician at Montrose.

AAgues having been endemick in this Place and Neighbourhood these many Years, I have had good Occasion of Experience in this Disease, and shall mention some Remarks I have made in the Cure of it.

I went on some Years in the ordinary Way
of

of vomiting on the Days of Intermission, as preparative for curing by the *Cortex*, till reading the old Physicians Books, I found they recommended Vomiting in the Beginning of the Paroxysm, thinking the morbid Matter was then disengaged and in Fluxion, particularly about the *Præcordia*, which they called its Concoction, and therefore was then fit to be pumped up from the Stomach, agreeably to that Aphorism of *Hippocrates*, Sect. 1. Aphor. 22. Πέπονα φαρμακεύειν καὶ πίειν μη ὥμα, &c. *Cocta non cruda esse movenda & medicanda.* Which Way of Reasoning is also agreeable to the Account given of the periodical Returns of the Paroxysms of intermitting Fevers by *Bellini*, and all who, since him, have wrote on this Subject in the mechanical Way.

Another Advantage seemed likewise to arise naturally from the Operation of Emeticks in the beginning Paroxysm, to wit, that by the vigorous Shock given to all the Parts in vomiting the morbid Matter might be sooner disengaged, and the Fit made shorter, if not prevented.

This Method appeared to me so reasonable and natural, that I began to give Emeticks upon the first Appearance of the Aguish Fit, and have found so good Success by this Way, that I have now continued in it these twenty Years past. The only Alteration I have made is, that if the Coldness of the Fit go soon of itself into a vigorous Shaking, without the Sicknes of the Stomach, I postpone Vomiting till the Sicknes begins in the *hot Fit*.

It is easy to see that in this Sickness, from
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the Flow of the morbid Matter towards the Stomach, one Half or two Thirds of an Emetick Medicine will do more and more effectually than the full Dose could do by straining Nature when otherwise at Ease. And indeed it would appear evident, that no straining by a vomiting Medicine can be well able to reach the Disease, while the morbid Matter is so blended with the other Liquors of our Body in the Intermissions.

I have frequently seen one Vomit thus given put away the Disease, or if another Paroxysm came on, it was so broken by a second Dose, that the Progress of it could scarce be observed. And I have always remarked, that when Patients were treated in this Manner, a third, fourth, or less Quantity of the Bark which was necessary to others, was sufficient to confirm and accomplish their Cure, or to prevent any Relapse.

The Success I had by giving Vomits in this Manner in Agues, encouraged me to try them also in the analogous Circumstances of other Fevers, and I have found, that by catching the Times when the *Horror* or Shivering and Sickness came on, to give a Vomit, the Relief and consequent Benefit were incomparably greater than when taken at any other Time.

It is with Pleasure I have observed our Physicians of greatest Practice very cautious in giving the Bark for Agues; they seem to follow the Directions of the wiser Antients, in allowing the morbid Matter to be concocted, and then to throw it out of the Body before they pretend to amuse their Patients with the Hopes

of a Cure, by suppressing for a little the uneasy but ordinary Symptoms of their Disease. Notwithstanding such good Example, and the many unhappy *Metastases* attended with such direful Consequences, which the too hasty and preposterous giving the *Bark* in great Quantities brings on, yet still there are many, who no sooner can determine their Patient's Disease to be an *Ague*, than they cram down as much *Bark* in the first Intermission as they think may make sure to prevent another Paroxysm; and if that does not succeed, they repeat the *Bark* as soon as the *Fit* is over.

To deter all from such dangerous Practice, I could bring many Instances of *Jaundice*, *Drop-sy*, *Asthma*, and all the Train of *nervous Disorders* brought on in a surprisingly short Time, after such preposterous Use of the *Bark*, which otherwise, when given judiciously after proper Evacuations, is a noble and safe Medicine in this Disease. At present I shall confine myself to two or three, where the Symptoms were very uncommon.

I. A young Man had taken five *Drachms* of the *Cortex* in each Interval of three Fits of a *Quotidian Ague*. Instead of the fourth Paroxysm, he had only a little *Horror* or Shivering. Next Day, after some Minutes shivering, his Ancles were vehemently racked, as if twisted and cut at once. This Agony lasted about five Minutes, when the Ancles being suddenly relieved, his Knees were as long affected in the same Way. Next the Joints of the Thighs were seized; to these succeeded a Hardness, Swelling, and Pains of the Belly. His *Thorax*

being next seized, he appeared as one strangled, then he fell down as Apoplectick, and lastly turned altogether delirious. When that ceased after five or six Minutes, he seemed well, about as long as from his Beginning to be attacked to his Recovery, and then underwent the same Symptoms in the same Order and Time. He was cured by strong large Blisters, Emeticks and nervous Medicines.

2. A young Gentlewoman labouring under a *Quotidian Ague*, with some hysterical Symptoms, had a Trial made of the *Bark* in small Quantity and slowly given; but upon observing the nervous Symptoms rather increase, I discharged the further Use of it. Notwithstanding this, it was given till the *Ague* ceased, when regularly at the Time of the Paroxysm, after a little Shivering, she became speechless, her breathing alternately interrupted about half a Minute, she inspired with a *Sibilus* through her Nose, had Contractions of the *Hypochondria*, and her Belly was drawn in, with Heavings and Fallings of the Shoulders, Contractions of her Neck, Stretching of the Arms and Grippings of the Fingers: She remained thus twenty five Minutes; recovered then as long as to take a little Sack-Whey, and relapsed into the former Circumstances. She remained thus four Months: After which she began to have longer Intermittions, and some more Variety in the Symptoms, but has now continued ill these nine Months.

3. A Gentleman long subject to the *Ague*, resolved to keep it off by a constant Diet of *Bark*, he got quite free of his *Ague*, but fell in-

to

to violent lowness of Spirits, and all the Train of nervous Symptoms.

XXV. *Anomalous Shakings after an Ague cured; in a Letter to Mr. MONRO Professor of Anatomy at Edinburgh, from Dr. ANDREW WILLISON Physician at Dundee.*

S I R,

YOur Design in concluding the History of anomalous *Shakings* after an ill-managed *Ague*, (See Art. XIX. of Vol. 2.) with a general Observation of the Methods of Cure in all you had seen or heard of, being unsuccesful, was, I am persuaded, to engage any who had the good Fortune to cure such Patients, to communicate their Method to the Publick for the Benefit of Mankind; and therefore, I hope the following History of a Woman whose Case was very like to the one related by you, will not be unacceptable.

In July 1733, an unmarried Woman about thirty Years of Age, of a plethorick Habit, who had laboured under a regular tertian *Ague* three Months, for which she had got some Herbs from a Gardner, which had stopped the Fits, came to ask my Advice. She was then frequently seized with an universal Shaking and Trembling over all her Body, which continued long. Sometimes these *Shakings* seized her Head so violently that two Men could not hold it, at other Times one or both Arms were thus also affected. Her Pulse was soft and languid, but her Veins appeared turgid. She had no Drought.

Her Appetite was lost. No Menfes had appeared for three Months. She knew when the Shakings were a-coming, and what Part or Parts would be affected ; for, she said, she felt a cold Wind coming into them. In the Intervals from *Shaking*, she was drowsy and inclined so much to Sleep, that she would have fallen from the Seat she sat on, unless she was supported.

I ordered her to be let Blood of at the Ancles, and to take two *Mustard Vomits*. Being little relieved by these, I desired her to try the cold Bath, and to rub her Extremities strongly when she came out of it.

After using this Method daily two Weeks, she came to return me Thanks, telling me she was perfectly recovered from all her Symptoms.

**XXVI. A Mania, from a callous Pia Mater ;
by Dr. EDWARD BARRY Physician at Cork,
and F. R. S.**

A Gentleman twenty five Years of Age, naturally of a dark melancholy Aspect and Temper, complained, about four Years ago, of a Weight increasing over his Head, which sometimes was attended with a Swimming and Giddiness, which threw him into fainting Fits, in which he often remained for a considerable Time deprived of his Senses. He said that he often escaped these Fits, by keeping his Eyes shut when that Pressure and Swimming seized him. About six Months before the Time I now write, his Friends observed his Temper much changed,

ged, and soon after he became distracted, attempting to destroy himself and others. This Maniac Disorder returned frequently upon him. In the Intervals he conversed and behaved regularly. For some Time past, he had frequently Paroxysms of a Fever which lasted three or four Days.

His Friends hearing some Instances of Success from the Operation of the Trepan in such Cases, resolved, after many other Methods of Cure had been attempted, to have this Operation performed.

The Day after the Operation I visited him, and saw him walk about his Room. Next Day he could not be prevailed on to rise; his Pulse became feverish, a slow *Delirium* and *Stupor* came upon him, with *Spasms* in his Limbs, which increasing notwithstanding Bleeding and other Medicines, he died on the tenth Day after he was trepan'd.

Upon removing the Skull, nothing preternatural was observed in the *Dura Mater*; but when this Membrane was taken off, several Physicians and Surgeons who were present, concluded from the Appearance of the *Pia Mater* on both Sides of the Brain, that a large Suppuration was extended under it; for it was of a Colour between green and yellow. Upon examining it, I found it hard and callous, and in most Places twice the Thickness of the *Dura Mater*. There was no Appearance of Vessels in it, and it cut like soft Horn. The cortical Part of the Brain, which this thickned *Pia Mater* covered, was much whiter than usual with few Blood Vessels. On separating the Hemispheres

spheres of the Brain, the *Pia Mater*, contiguous to the *Falx*, appeared in the same morbid Condition. The *Ventricles* of the Brain were very large, and distended with Water.

XXVII. *An Epilepsy, from an uncommon Cause; by Dr. THOMAS SHORT Physician at Sheffield, and F. R. S.*

IN July 1720, a Woman about thirty eight Years of Age was brought to me; she had laboured twelve Years under an *Epilepsy*, which, from one Fit a Month, was come to four or five violent ones every Day, each continuing an Hour, or an Hour and a half; by which she was rendred moppish and silly, and incapable to take Care of her House and Family. Her Husband was reduced in his Circumstances, from his Affection and Care for her, having got and followed all the Advice he could. Evacuations of all Kinds had been tried; the epileptick and cephalick Tribe of Medicines had been ransacked, and many other Medicines had been used in vain; the Disease growing more severe. Her Fit always began in her Leg, toward the lower End of the *Gastrocnemii* Muscles, and in a Moment reach'd her Head, threw her down, foaming at the Mouth, with terrible Distortions of the Mouth, Neck and Joints. Whilst I talked with her she fell down in a Fit: I examined the Leg, and found no Swelling, Hardness, Laxness or Redness different in that Place from what was in the other Leg: But suspecting from her Fit beginning always at that Part, that the Cause of her Disease lay there, I immediately

dately plunged a *Scalpel* about two Inches into it, where I found a small indurated Body, which I separated from the Muscles, and then took it up with a *Forceps*; it proved a hard cartilaginous Substance or *Ganglion*, about the Size of a very large Pea, seated on a Nerve, which I cut asunder, and took out the Tumor. She instantly came out of the Fit, cried out she was well, and never after had a Fit, but recovered her former Vigour both of Body and Mind.

XXVIII. *Of the Cure of an Ulcer of the Lungs
by Blood-letting; by* —————

Gentlemen,

IN my present Circumstances it would be inconvenient for me to appear openly as an Advocate for the Cause which I here plead: This obliges me to beg you would suppress my Name, if you think fit to publish this Essay; which, though it should be generally condemned, may at least have the good Effect of engaging others to contrive a more successful Method of Cure than has hitherto been made Use of in this frequent and most dangerous Disease the *Consumption*. I flatter myself you will more readily allow me to remain concealed, that I have advanced no Facts which require a particular Voucher; and that you will thereby much oblige, *Yours, &c.*

THE *Ulcer of the Lungs* is a Disease so frequently fatal, that some of the ablest Physicians make it a Question whether ever a Consumption from that Cause has been cured. And indeed

indeed whoever considers the important Office of this *Viscus*, its spungy Texture, its perpetual Motion, and the particular Rapidity with which the copious Blood pours through its Vessels, will not be greatly surprised that a Suppuration here should so little yield to the Efforts of Physick.

A good many different Methods of Cure have been tried, but none of them is much celebrated for its Success: A new one has been lately recommended, which, in my humble Opinion, is by no means absurd, I mean that of frequent Bleeding in small Quantities.

Young People of plethorick Habits, and such as have been accustomed to frequent Blood-lettings, are very often subject to this Disease; and in these it is generally observed to be most acute, and to slide on the fastest to its Catastrophe. In such Patients I should take Dr. Dover's Method of Cure to be extremely reasonable, especially if it is used with proper Cautions, and before the Constitution is much drained of its natural Fluids.

I shall offer the Reasons that occur to me in Behalf of this Doctrine. Any body, I believe, will allow, that to heal the Ulcer is to cure the Disease; and this Method, I think, bids as fair to do that as any. 'Tis granted on all Sides, that some Degree at least of a Fever, is necessary to the making of *Pus*, and that the Quantity of *Pus* will always be, *cæteris paribus*, in Proportion to the Force of the Heart. 'Tis likewise undeniable, that the more the Circulation is hurried, the Constitution is the more heated, the purulent Matter acquires the greater

ter Virulence, becomes the sooner thin, and is the faster resorbed; while in the mean time the circulating Fluids are attenuated, exalted, and expelled the faster. Thus the whole Train of he&tick Symptoms is very remarkably influenced, or rather, their Degree of Virulence is intirely determined by the Velocity of the Blood. The resorbed *Pus* occasions the he&tick Fever, and that again prepares new *Pus*; that is to say, supplies fresh Fewel to the Disease. And thus the Struggle is maintained till the Heart ceases to beat.

Now as Blood-letting is the most effectual Way to abate the Force of the Heart, it must of course diminish the Quantity of *Pus*, and alleviate all the bad Symptoms that owe their Origin to this *Fomes*. The mere subtracting of acrimonious Blood too seems to be no despicable Advantage, since this Diminution may easily be repaired by the Addition of more laudable Juices from the Aliments, which in this Case ought always to be of a mild kindly Nature, easily elaborate, and for the most part acescent, to be administred frequently and in small Quantities at a time. And besides, if Bleeding takes off, or considerably abates the he&tick Fever, it may come to be no real Expence at all, since by this Means the great Waste of Fluids, by colliquative Sweats, or Diarrhœa, will be saved. For which Reasons it might perhaps be, with proper Cautions, ventured upon, even in Patients that are already pretty much exhausted: Seeing it is certain that their Vessels are still exquisitely full, and may in Proportion to their contracted State, even suffer a *Plethora*; which appears

appears frequently in the weaker Sex, who are frequently visited with regular Returns of their *Menses* to the very last Stage of the Disease, notwithstanding all the Loss they undergo by plentiful colliquative Discharges.

But the good Success of Riding, and other Exercises, in the Cure of Consumptions, may be objected to this Reasoning; since these Concussions and Agitations of the Body should, according to this Scheme, by accelerating the Motion of the Blood, rather aggravate the Malady, and spur it on to its last fatal Stage, than contribute to its Cure. This Fact at first Sight seems to shake the Doctrine here advanced; but when more narrowly considered, I am apt to think it rather strengthens it: For besides the Advantages of corroborating the flaccid Fibres, and compacting the melted Fluids into a just Density, there is perhaps a very considerable one procured from these Exercises, by their enabling the Vessels to throw out the purulent *Miasmata* as fast as they are taken in; and as by this Means an Accumulation of re-forbed *Pus* is prevented, the hectic Paroxysm, during which the Ulcer is most supplied with new *Pus*, is either quite cut off, or much mitigated.

In a Word, the particular Violence with which this Disease is observed to act, and the uncommon Dispatch with which it proceeds in plethorick Habits and warm Constitutions, plainly seems to indicate this Practice, at least, in such Patients.

Blood-letting will, for the same Reasons, be equally justifiable in all internal Ulcers, though there

there seems to be the greatest Necessity for it, when the Lungs are the Seat of the Disease, upon account of the abundant Torrent of Blood that rolls with so much Fury through their numberless Vessels.

Before I put an End to this Paper, I must take the Liberty to propose a few Queries, concerning the Management of Consumptions by this Method, which I shall submit to the Consideration of proper Judges.

1. Whether is it not a reasonable Piece of Caution to abstain from Bleeding, as long as there are any well-grounded Suspicions of Abscesses yet unbroken in the Lungs, since Bleeding in that Case would only weaken the Patient to no Purpose? And whether all the proper Methods of deterging and expectorating ought not to be diligently used before Bleeding is called in?

2. Whether it is not the most proper Time to let Blood when the Patient is pretty much recovered from the Fatigue of his last Paroxysm, after his having cleared his Lungs as much as possible by coughing?

3. Whether in the very Time that the Blood springs, it may not be adviseable to make him draw in gently astringent, drying and balsamick Steams, such as of *Myrrh*, *Mastick*, &c.?

4. Whether the more volatile, detergent and antiseptick Medicines, such as *Aloes*, *Myrrh*, *Vinegar*, kindled *Pitch*, *Sulphur*, &c. might not be happily conveyed to the Lungs in this Shape?

5. Whether there may not frequently be Harm in insisting much upon Expectoration?

since by this Means the Ulcer is still kept crude; the *Plexus* of new tender Vessels is broken in forming; the Lungs are robbed of that lymphatick and mucous Moisture, which would much contribute to heal the Ulcer (*a*); and their Nerves are laid bare to every stimulating Cause, whence an incessant Cough, and all its bad Effects. May not antiseptick Steams, and a mild acescent Diet, Issues, &c. much take off the Necessity of expectorating Medicines? Are mild Pacificks (the Preparations of our own Poppies, especially their Seeds, in Form of Emulsion) mixed in small Quantities with balsamick refrigerating and gently detergent Materials, to be allowed only at Night? And even during the Operation of the Paregoricks, will not the Lungs, (if their Tone is not much enervated, and the Opiates are not too strong) when their Vessels begin to be overburdened, be sufficient of their own accord in most Cases to expel the offending Load, without the Assistance of any more artificial *Stimulus*? Does not the Success of Opium in the Catarrh, even when the Mucus is very thick and hard to be discharged, warrant this Practice, and even invite us to it?

Lastly, Would not the Bark and other Medicines that corroborate, without stimulating much, Frictions, and gentle Exercise be necessarily used at the same Time with Bleeding, to assist in curing the hectic Fever, and to prevent Crudities, hydropick Collections and Tumors,

(*a*) This is in consequence of an Observation made in an admirable Essay on the Nutrition of Fœtuses, in the Second Volume of *Medical Essays*, p. 151.

mors, and other bad Symptoms that might probably be introduced by Loss of Blood?

XXIX. *A Collection of Matter in the Liver evacuated by Stool; by Mr. JAMES JAMIESON Surgeon in Kelso.*

ON the 2d of May 1729, I was called to see the Wife of George Tait Inn-keeper in the Town of Yettam, who for some Years had been afflicted with Pains about the Region of the Liver, a short and dry Cough, Loss of Appetite, irregular Tremors, and feverish Paroxysms like these of an Ague, and a Suppression of the Catamenia. After she had continued in this State about two Years, an unequal Tumor appeared immediately under and before the *Costæ nothæ*, proceeding gradually both Ways; till crossing the *Linea alba*, some Inches below the *Umbilicus*, it filled the whole *Epigastrium*, to the *Cartilago Xiphoides*, forcing the Muscles externally to very unequal Projections, and hard to the Touch. To her former Complaints were added Vomitings, and a continual hectic Disposition, whereby she became much emaciated, and her Belly always costive during the whole Course of her Illness.

In this Case I found her the first Visit, and advised calling a Physician, which she absolutely refused, from an intire Diffidence of her Recovery, joined with mean and low Circumstances of Life, wanting only Ease from some of the most painful Symptoms, desiring all the Help I could give her thereto, which was endeavoured by the following simple Method,

viz. I ordered her to take a gentle Dose of the *Pilul. benedict.* with *Calomel.* at Bed-time, and to repeat it every Night or second as she found it agreed with her. To use Morning and Evening an emollient, and aromatick Fomentation, the same Materials being sometimes used for Cataplasms.

From this Time I did not see her till the sixth Day thereafter; when being sent for in Haste, I was surprized to find the Swellings entirely gone, and the Patient chearful in Hopess of Recovery, and only now complained of a Fulness in the *Hypogastrium*, with a little *Dysuria*. Upon striking that Fulness with my Finger, I found the Contents fluctuate; whereupon I not only advised the continuing of the *Pills*, but an Infusion of the aromatick Diureticks in White Wine, with *Millepedes* and some of the *Sp. nitr. dulc.* with the above Fomentation used only at Night, and so left her.

On the fifth Night thereafter, an Express was sent for me to see her die, from a purging off her Intestines (as the Messenger express'd it, by Commission from both his Master and the Patient) which I found was occasioned from a Stool she had had in the Night, whereby about a Pound of a *parenchymatous* kind of Substance, the Thickness of brown Paper all cohering, off the Toughness of well boiled Tripe, and dia-phaneous, was discharged, without any other Excrement. This I caused to be put into a Gallypot with some Brandy, brought it home, and shewed it to the Physicians and Surgeons here, and to that curious Observer Mr. *Monro*,

the

the Professor of Anatomy, who happened to be at Kelso in a short time after.

From that Time to this, the Patient has continued well, and I am informed is in perfect Health at writing hereof.

XXX. *An uncommon Dropsey, from a steatomous Omentum; by ALEX^r. MONRO, Professor of Anatomy in the University of Edinburgh, and F. R. S.*

Christian Seton was subject to the *Erysipelas* in her Legs from her Youth. At thirty one Years of Age married, but never conceived. Her *Menses* left her when she was thirty nine Years old. Three Years after, *viz.* in *July* 1727, she perceived her Belly turning bigger than naturally it used to be, which she imagined was occasioned by a Draught of sour Wine which she had taken two Years before. In *August* following, her Legs also began to swell, when she asked Advice of some Physician, who ordered her several Purgatives and other Medicines, notwithstanding which, her Disease increased very fast.

When I first saw her in the Beginning of *O-
ctober*, her Belly was swelled so big as to reach down beyond the Middle of her Thighs when she was sitting: The bastard Ribs and *Regio Epigastrica* were violently protruded outwards, and the Point of the *Xiphoid Cartilage* was turn'd directly forwards. Her Thighs and Legs were oedematous, and double their natural Thickness. The upper Part of the Trunk of her Body, her Face and superior Extremities

were greatly emaciated. She had no Appetite for Food, but had a Thirst, though not violent. Her Tongue was moist, but slimy. She was costive, and passed very little Urine. The Pulse was weak and frequent. The Breathing so difficult, she durst not ly down, but was obliged to sit always in an erect Posture. A perpetual Cough, Night and Day, kept her from Sleep, and with the Cough she spit up a thick Mucus. She was so weak as not to be able to stand. On striking the Belly, the Fluctuation of Water was plainly felt. To all these Symptoms was added one of the worst Circumstances can happen in such a Disease, Want of Attendance and of the common Necessaries of Life.

Several of the most pressing and uneasy Symptoms in her Case depending on the violent Distension of her Belly, I resolved to attempt giving her some Relief by tapping her, which I performed in Presence of my Colleague Dr. John Innes Professor of Medicine, Mr. Charles Allan Surgeon, and several Students of Physick, and let out six Scots Pints, or twenty four Pounds of Water, which at first came off briskly in a Stream, but in a little only dropt from the Canula of the *Trocar*, and at last stopt intirely before the Swelling of the Belly was near gone; though I took Care, during the Operation, to keep the Abdomen tightly compressed with a Belt, and Assistant's Hands, and to clean the Pipe frequently, by introducing a Probe through it. The Patient bore the Evacuation without the least Fainting, and I left her easier with the Belt I commonly use on these Occasions, well charged with the Fumes of

Benzoin,

Benzoin, Mastich and Succinum, applied to her Belly, and drawn pretty tight. In the Evening she took a cardiac Mixture with some Drops of liquid Laudanum; she slept well all Night, and was considerably refreshed in the Morning.

The *Regimen* now ordered her was to drink none, or very little; but when she was thirsty, to put a little bit of Tamarinds mixed with Crystals of Tartar into her Mouth; to eat Fleshes, or with any other Food to mix Wine and Spiceries; which would appear a ridiculous Direction for one in so much Poverty: But the Honourable Mrs. Margaret Balfour of Burleigh, moved with her wonted extensive Charity, had promised to supply every Thing necessary for Diet or Attendance; and as long as my poor Patient lived, the Promise was most punctually and bountifully performed; for that Honourable Lady not only gave Orders to her Servants to execute whatever Directions I gave, but carefully inspected the due Execution of them. Every Day the Patient's Belly was well rubbed with Flannels strongly charged with the aromatick Fumes. Every 4th Day she had a Purgative given her of *Decoct. amar. cum dupl. Senn. Unc. ii. Oxymel. Scillit. Unc. sem. Syrup. de Rhamn. Unc. i. Pulv. Fallap. Scrup. i. Misc.* And four Times every intermediate Day she took the Bulk of a Nutmeg of an Ele-*ctuary composed of Rad. Helen. Irid. Florent. Gum. Ammon. and Honey*, washing each Dose down with $\frac{1}{4}$ of the following Liquor, & *Decoct. amar. Unc. iv. Sp. Succin. Drach. iii. Misc.*

By

By the Use of this Sort of Diet, and of these Medicines, she passed very large Quantities of Water both by Stool and Urine ; and in a few Weeks all her Symptoms went off, except the Swelling of her Belly, which was however greatly diminished, and gave her no Uneasiness.

In the Month of *February 1728*, having sat long in Church, exposed to the Air, which was then very cold, and having neglected to take her Medicines some Time, the Quantity of her Urine lessened much, she became costive, and the former bad Symptoms returned. Nor could I after this procure the Evacuation of Water which had been so beneficial to her, by any Medicines ; so that she in a short Time relapsed into as bad Circumstances as when I saw her first, with the Addition of a very sharp Pain under her short Ribs, especially of the left Side.

On the 2d of *July* I again tapped her with a larger *Trocar* than what I had formerly made use of; and drew off first *Mucus*, then *Pus* which sunk immediately to the Bottom of the Vessel where the *Mucus* had been put, and had white Membranes mixed with it. These two Liquors, *Mucus* and *Pus*, ran alternately, till I had evacuated in all sixteen Pounds, when no more would run : and in the Time of the Evacuation I had frequently been obliged to draw out the tough slimy Stuff, which stopt the Pipe, with a Probe. When I thrust the Probe softly into the Cavity of the Abdomen, it was soon resisted by a firm solid Substance, which on the least Touch bled. The lower Part of
the

the Belly subsided remarkably on this tapping, but the *Regio Epigastrica* yielded nothing.

The Patient being no way relieved by this Evacuation, I again tapped her on the 14th July, but was resolved to prevent the Matter contained from being stopt by a narrow *Cannula*; and therefore performed the Operation with a *Trocar* as large as my little Finger, but could bring away only eight Pound of purulent Matter. The poor Patient daily turning worse, died ten Days after; and I was allowed to examine the Body.

Before I give an Account of what I observed there, I must ask Pardon for pretending to refer to such indifferent Figures as I send you with this Paper; but Necessity obliging me to commence Painter at that Time, and being sensible of the Difficulty there is to represent Things, especially such as are out of the common Order of Nature, in Words, and knowing my own Insufficiency that Way, I was afraid not to be understood without them: To prevent Obscurity therefore to your Readers, or the disfiguring of your Book with bad Figures, I beg you'll be so good as to correct either the Description or Figures, or both.

The Body being laid on a Table, had the Appearance represented, *Tab. IV. Fig. 1.* The Belly A hanging down over the Thighs, and monstrously swelled every where, but with a Depression D cross the Belly about Mid-way between the Navel B and the *Sternum*, the under Part of which was advanced, and the Point of the *Xiphoid Cartilage E* was directed straight forwards. The *Hypochondria* were also considerably

siderably raised. The Thighs F and Legs were greatly oedematous, and the rest of her Body was much emaciated.

The *Tunica cellulosa* of the Abdomen was very thin, without any Water contained in it. In cutting through the Muscles and Peritoneum, on the left Side of the Navel, two Pound of yellow Water ran out; and from the Cavity G (Fig. 2.) where this was lodged, ten Ounces of *Pus* were taken, with white tender Membranes swimming in it. Having cut the containing Parts from the Navel to the left Loin, no more Water appeared, but eight Ounces of *Pus* were collected. All round the Cavity, in which the Water and *Pus* were lodged, I observed a white hard Substance, seeming to be composed of conjoined Vesicles, and adhering strongly to the *Peritoneum*. This I dissected away from the *Peritoneum*, till in cutting upwards I had reached half-way between the Navel and *Sternum*, when it adhered so very close, and became gradually so thin, that I was of Opinion I would sooner and better discover what it was, and how far it reached, by cutting it thro' at H, and opening into the Cavity; which therefore being done, I raised the containing Parts strongly, and looking behind them saw this knotty Substance BB adhering to the *Peritoneum* three Inches further up, and then separating from the *Peritoneum*, it was extended backwards, and supported a considerable Quantity of Water D lodged above it. I next with my Scissars cut close off from the *Peritoneum* that Substance, which being extended from one Side of the Abdomen to the other,

served

served as a sort of transverse *Mediastinum* or *Diaphragm*, to divide that Cavity into two. After this seeing nothing more above the Navel in Danger of being destroyed, I divided the containing Parts in the common Way of Dissection, and turned up the two Quarters of the Teguments, now raised on the Ribs, to have a better View of the vesicular Substance BB adhering to their internal Surface: It consisted of a fatty Membrane, beset with vesicular Bodies, full either of Mucus, or of a white hard steatomatous Substance. The *Regio Epigastrica* C, Fig. 1. was exceedingly enlarged, and out of the Cavity D, Fig. 2. and 3, form'd in it, I took with a Sponge thirty Pounds of Water, which had pressed out the surrounding Bones, and had thrust the Diaphragm considerably upwards. I next dissected the Teguments from the vesicular Body F, Fig. 2. as far as it reached, which was to the *Offa Pubis*; and then divided them in the ordinary Way.

All the Teguments being thus removed, I view'd carefully the Contents of the Abdomen, yet in Sight: At the upper Part, I saw the great Cavity of the *Epigastrium* D. Below this appeared a very large membranous Sac C, of a brownish black Colour, distended with Air, and reaching from the Extremity of the Cartilages of one Side to those of the other, when it sunk down under both *Hypochondria*; the middle Part of it was much the largest, and no Division into Cells, or longitudinal Ligaments, were to be seen on it; though I found evidently afterwards it was the *great Arch of the Colon*. The Part of the fatty membranous Body

Body left, when I cut this in raising the two superior Quarters of the Teguments, mounted over this Sac ; and then sinking backwards, adhered to another *Viscus*, which I could not yet discover, without putting some Parts out of their Situation ; and from the under Part of this same Sac depended a white vesicular fatty Substance, with large Blood-vessels, I, spread on it : This at first was thin, but gradually as it descended became thicker, till it was hid by the anterior *Lamella* which had been dissected off from the *Peritoneum*. When this last was raised, I softly thrust my Hand into a large Bag form'd between the two, as far down as the *Ossa Pubis*, where they made one continued Substance. Besides these I could observe no other *Viscus*, except the *Cæcum* or great *Sac of the Colon K*, lodged in the Cavity of the right *Illa*: Wherefore I dissected that vesicular Body away from all the Parts it was contiguous, or adhered to ; and, in cutting, remarked, that all the little Cells, opened in this Dissection, poured out Water. When this Body was wholly removed, (See Fig. 3.) I could not at first discover any thing in the Cavity below, except a flat circular Protuberance L, lying on the *Vertebræ*, covered with a dirty-black-coloured Membrane, and this, in a great many Places, had a white tender Membrane, resembling the Pellicle formed on boil'd Milk when it cools, lying upon it. The Cavities of the Loins were very large, and filled with Water as well as the *Pelvis*, and under the Water *Pus* was every where found. When these Liquors were taken out with a Sponge, the Surface of the Cavities

Fig. 1

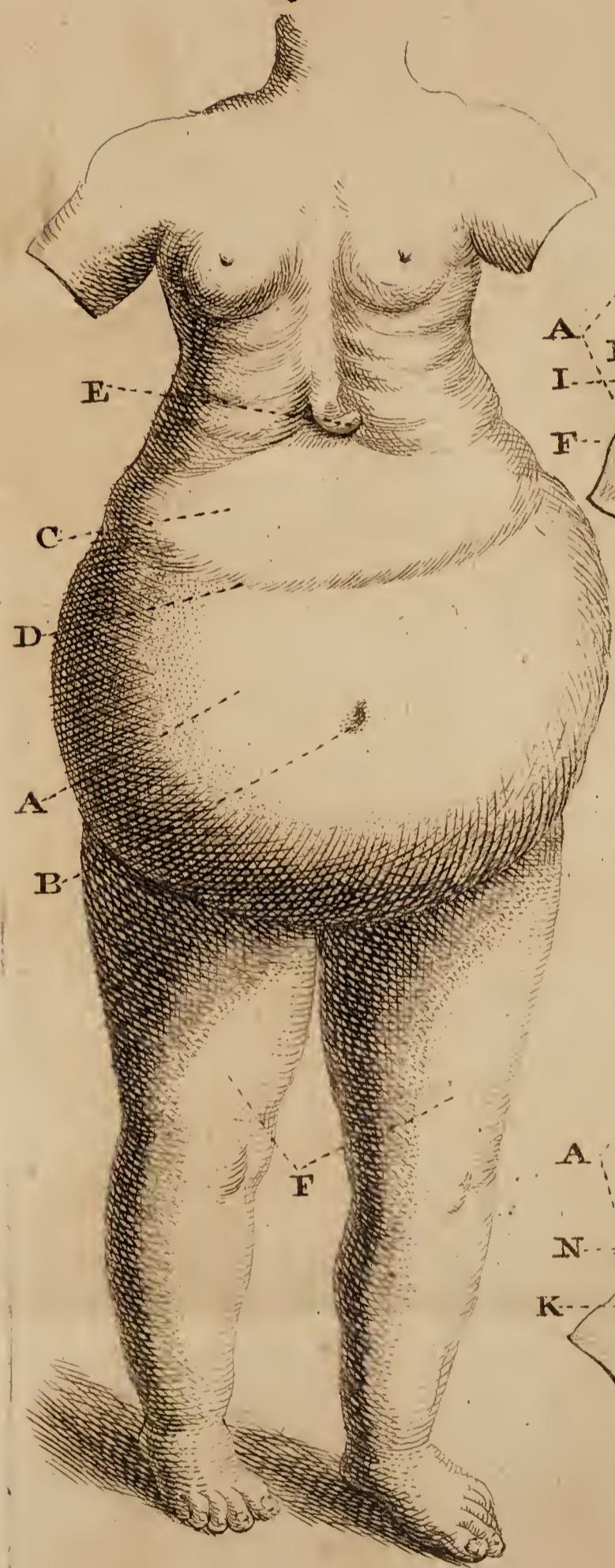


Fig. 2

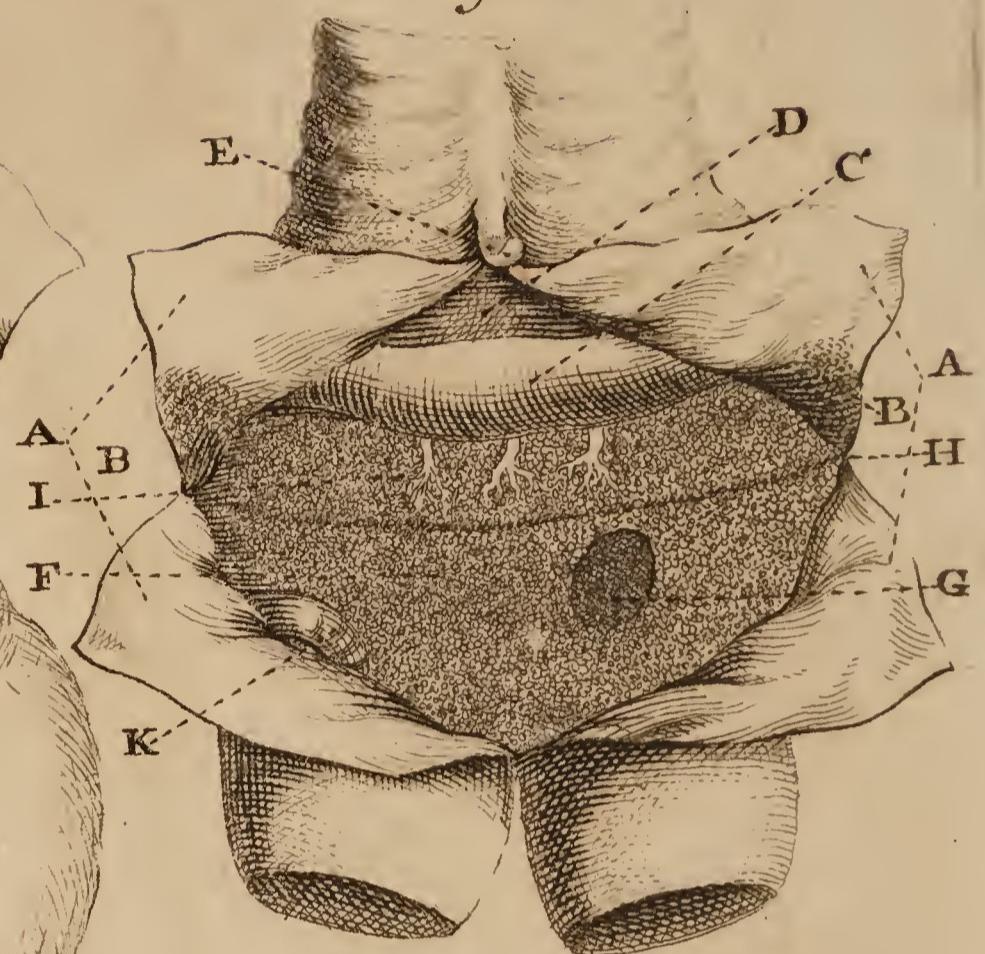
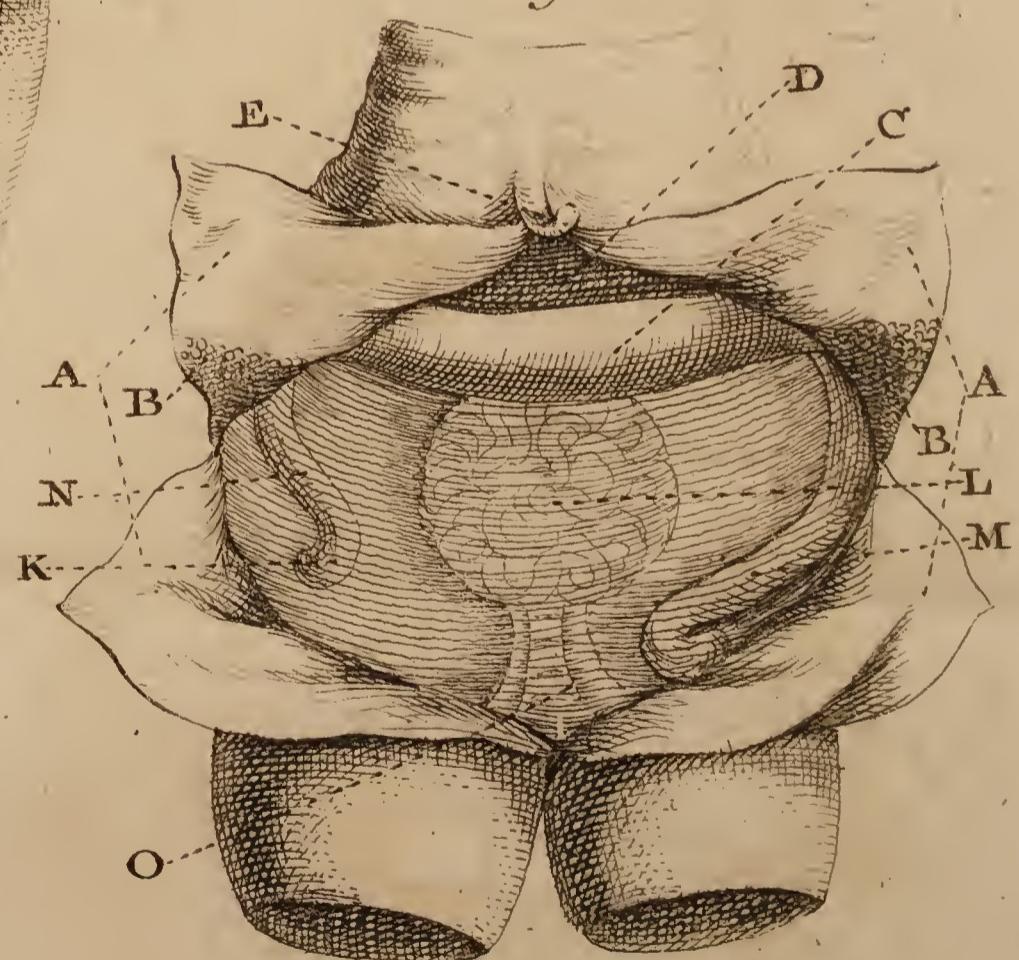
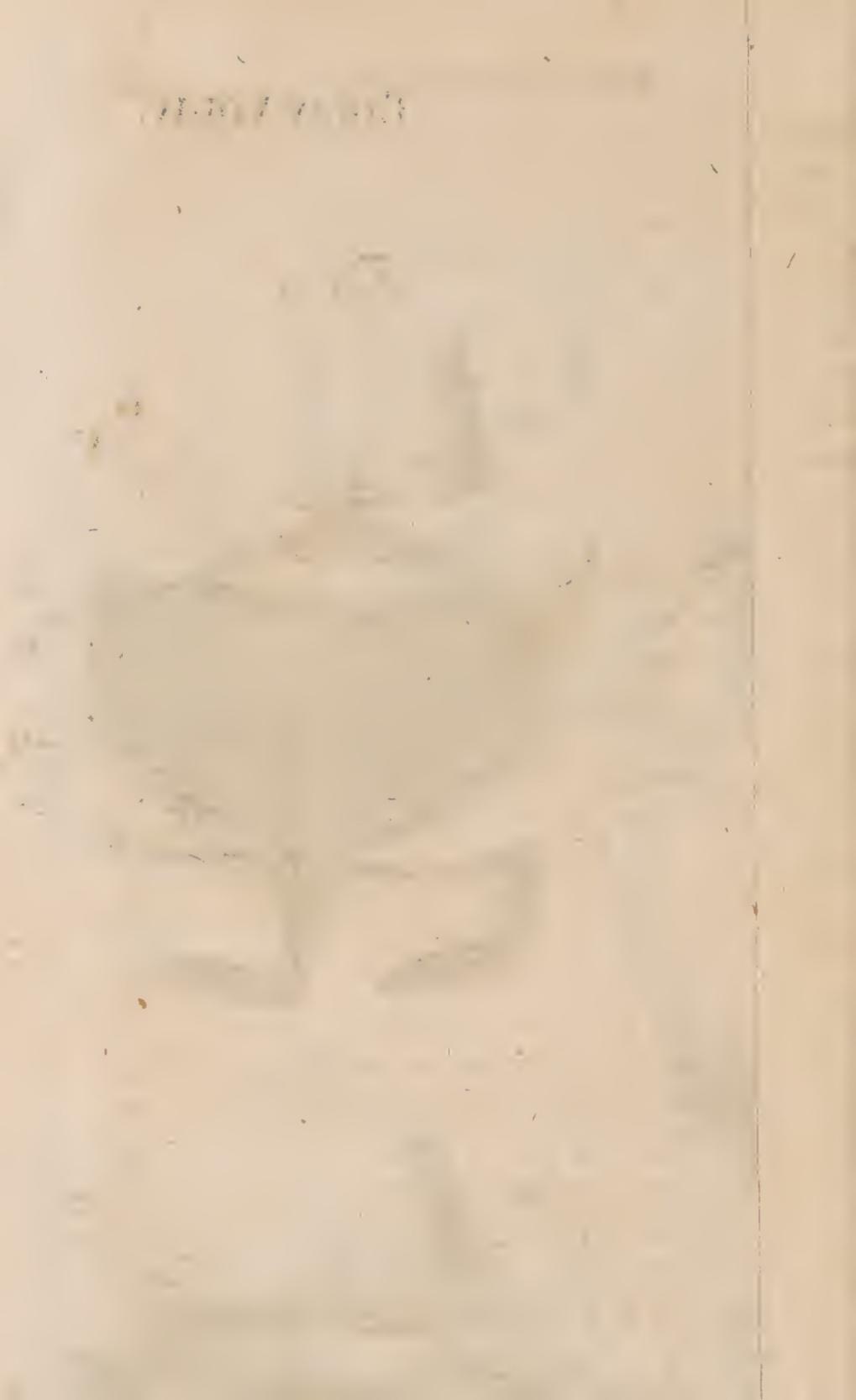


Fig. 3





vities had much the same Appearance with that of the large middle Protuberance. The cellular Substance surrounding the *Pelvis* was two Inches thick, and distended with Water and Mucus.

Looking at last narrowly to the great protuberant Body, I perceived some faint Resemblance of the Convolutions of the small Guts appearing through the black Membrane, and discovered the *Colon MN* in the same way in the Loins. When the Membrane was dissected off, all the Intestines came in View, of the Colour and Size of which they are commonly found in hydropick emaciated Bodies; but the small Guts and Folds of the Mesentery, where they were contiguous, slightly adhered to each other by a weak Sort of Membrane, which, when tore, by gently drawing the *Viscera*, yielded Water out of its Cells.

The great Guts were distended with Air, and in a natural enough Condition.

The *Mesentery* was shorter than ordinary, but otherwise sound.

The *Stomach* hid in the great *Epigastric Cavity*, was very little larger in its transverse Diameter than the small Guts, but of a natural Colour, without any black Membrane over it. From its *Fundus*, the Remains of the cut *mentum* depended, which was the vesicular Substance I at first divided in opening the Abdomen.

The *Liver* was quite hid under the bastard Ribs, and adhered so firmly to the livid *Peritoneum* by its Membrane, which was about a quarter of an Inch thick, that I could not ob-

serve its Colour or Substance, till I had taken off the Membrane, when this great Bowel look'd pale, and had very little Blood in its Vessels.

I found no Concretion in the *Gall-bladder*.

The *Spleen* was much in the same Condition with the Liver.

The *Pancreas* was pale and hard.

The *Kidneys* were in a natural Condition, but with little Blood in them.

The *Ureters* were of the ordinary Size.

The *Bladder*, *Ovaria*, *Tubæ Fallopianæ* and *Uterus* were all sound, only covered with a thick livid Membrane.

The Water and *Pus* taken out with Sponges amounted in all to forty Pounds.

I caused a Servant to carry home the large *vesicular Body* which occupied all the anterior Part of the Abdomen, and there examined it. It consisted of two *Lamellæ*, which were thin above; but gradually turned thicker as they descended, till, at the lowest Part where they united, they were six Inches thick. Each was covered all over with a smooth Membrane, only the anterior was ulcerated at its superior external Part. Several Ounces of purulent Matter, with Pellicles swimming in it, were taken out from the Cavity form'd between the *Laminæ*. When the external Membrane was separated, each seem'd to consist of Vesicles of different Sizes, some of which were distended with Water, others with Mucus, and a third Sort with a steatomatous Stuff. So far as could be discovered, there were no communicating Passages immediately from one Vesicle to another.

From the whole there is Reason to conclude this

this Body to have been the *Omentum* diseased; which very probably might be the Cause of the *Dropsy*, as well as Tumors of other Parts frequently are, of which I have seen several Examples.

Whether is it peculiar to the membranous Parts, when suppurated, to have Pellicles, like to that which gathers on boil'd Milk, mixed with the Pus? I have seen them after Inflammations of the Guts, *Pleura*, and in the foregoing History of the *Omentum*.

Whether are those Pellicles, the Membranes, separated and turn'd tender by soaking, or the Particles of the *Pus* adhering and pressed firm?

XXXI. A total Obstruction of the Valve of the Colon; by Dr. THOMAS SHORT Physician at Sheffield, and F. R. S.

April 24th 1726, I was called to *Griffin Lee*, who sold Mild-Beer in *Coventry*, aged about Seventy, of a phlegmatick Constitution and gross Habit of Body, and had a *Hernia intestinalis* for many Years. He had become constipate twelve Days before. The first Week he took no Medicines; the next he was attended, and had several Things from a very honest ingenious Surgeon; during which he was not wholly deprived of Stools, but the *Fæces* were very inconsiderable, small and hard, and he had vomited what he swallowed, with fetid Excrements. From the *Thursday*, when I was called, to *Monday* after, he had several Motions, but no Stools. He complained of a sharp Pain in his Belly, especially in that Part

where the *Ilium* ends and *Colon* begins, and indeed all over the *Ilium*, with a Sense of Weight and Fulness. His *Hernia* was not then down; his Sicknes was little; he was able too rise, walk about, eat and drink, if it could have found Passage. I prescribed a great Variety of Laxatives in different Forms, to no Purpose. I ordered Air to be forced *per Anum* by a Bellows; it returned immediately withoutt *Fætor*. He lived till *May* 2d, with the swelling of his Belly and other Symptoms increasing.

After his Death, the Passage at the *Valve* off the *Colon* was found shut up, and about two Fingers breadth of the Gut there was degenerated into a hard solid Substance, below which there were no *Fæces*. The small Guts were much inflamed and livid.

XXXII. The Case of a Male Child born withoutt an Anus or Intestinum rectum; by Mr. JAMES JAMIESON Surgeon in Kelso.

SOME Years ago Mrs. *Hannah*, Midwife in this Town, was called to one Mrs. *Stevenson* in *Plowland*, five Miles distant from this Place, whom she delivered of Twins, the one Female, the other Male; and discovering in the latter no Appearance of an *Anus*, came home, and sent me to see the Child, whom I found otherwise sprightly, and seemingly in perfect Health, but not the least Vestige of an *Anus* to be seen or felt, but equally firm and solid from the *Coccix* to the *Scrotum*: Whereupon I told the Grandmother, who only was acquainted

acquainted therewith by the Midwife, that it was preternatural, and that though I had twice seen the *Anus* covered by a Membrane, which was easily cured, I could not propose to do the like in this; but if she pleased, I should try to reach the Gut by Incision, which she, with the Mother's Consent, fondly agreed to: Whereupon I made an Incision pretty deep in the most reasonable Part, then introduced my little Finger into the Wound, to find the Gut, but in vain.

I afterwards tried the *Trocar*, which penetrated, but nothing followed but some Gutts of Blood; so was obliged to leave the Patient without Prospect of further Help from me, only desired that when he died, I might be allowed to open the Body, which I did next Day.

Upon opening the Child, I saw the *Rectum* entirely wanting, and the *Colon* was a perfect *Intestinum cœcum*, suspended loosely in the Abdomen, and full of *Meconium*; all the other Parts being in a natural State.

XXXIII. Coagulated Blood extravasated upon the Uterus, and the Thickness of the Womb, in a laborious Birth; by Mr. JOHN PAISLEY Surgeon in Glasgow.

Authors having differed very much as to the Thickness or Thinness of the *Uterus* of a Woman with Child; some with Mauriceau and Dionis (a) asserting that it turns always

G g. 3

thinner

(a) Mauriceau maladies des femmes grosses, chap. 4. de la matrice. Dionis, chap. 1. lib. 1. Midwifery.

thinner as it extends, whilst others, I may say almost all Anatomists, affirm that it turns thicker as the Woman advances in her Pregnancy, and draws nearer to the Time of her Labour; or, to speak more properly, that in the several Stages, the Thickness of the Sides of the Womb keeps the same Proportion to its Cavity as in a natural State, the *Sinuses* and Vessels being proportionally enlarged as the *Uterus* is extended: I say, this having occasioned some Disputes, amongst Anatomists, I thought proper to send you the following History of a Woman who died in Child-Labour, where I had an Opportunity of observing the Thicknes of it, and at the same Time of discovering a fatal Mistake in the Midwife who attended her, who, by delaying to call for Assistance in due Time, was the unhappy Occasion of the Death both of Mother and Child.

Upon the 9th of June 1730, I was called to a Woman in Labour, about a middle Age, of a low Stature, and pretty fat, who had born several Children; and found her in an exceeding low Condition, with cold Sweats, severe Faintings, her Extremities cold, without any Pulse, and unable to utter one Word, though she shewed some Signs of her being desirous to speak with me. The Midwife that attended her had gone off upon my being sent for, and left a young Practitioner whom she was training up in that Business, who gave me the following Account of the poor Woman's Case, *viz.* That she had been several Days in Labour, and that all along the Midwife imagined Affairs were in a very good Way, and the Child, as she thought,

in a very right Posture; though after the Waters broke, the Child's Head had never advanced by the strongest Pains. Hence the Midwife either blamed the Mother for not bearing down strong enough when the Pains came upon her, or else pretended that the Pains were too faint and languid; and as there was no Flooding, she never apprehended any Danger, and therefore cheared up the Mother and Friends with the Hopes of a good Issue by a little Patience: And as she had a good deal of other Busines upon her Hand, she frequently left the Poor Woman for half a Day together, and, upon her Return, still found all Things in the same Situation as she left them. From the first Day the Woman was taken with her Pains, she scarce made one Drop of Water; wherefore on the fifth, the Midwife suspecting that to be the Cause of the Birth's being retarded, she sent to an Apothecary's Shop for a strong stimulating diuretick Mixture, to increase her Pains and provoke Urine, being assured all Things were right, only the Pains were too faint; as no Doubt they were, when the Woman had been so long fatigued with her Labour. This having no Effect, a stronger one was called for, which proved likewise unsuccessful; and all Things continued in the same State, only that the Woman's Strength was continually decaying, till the sixth Day at Midnight, when I was sent for, and found her in the Situation above mentioned. It is evident, when Matters were brought to this Pass, that the poor Woman had not so much Strength left her as to bear the Fatigue of being put into a Posture for being delivered, and that it was impossible

impossible to afford her any Relief. I acquainted the Friends with it, assuring them that it would be Madness to attempt it in these Circumstances, being perswaded she could not live above a Quarter of an Hour; which accordingly happened, she dying in a few Minutes.

Next Day I prevailed with the Friends to have her opened, and after I had cut the Teguments and laid them back, I was surprized to meet with a black membranous Body like coagulated Blood, (which it in Reality was) covering all the Fore-part of the *Uterus*, though distended so much with the Child. This I easily separated in one Cake from the *Uterus*, and when it was spread upon the Table, it was about a Foot and a Quarter long, a Foot broad, and a quarter of an Inch thick. Whether this proceeded from the ouzing out of Blood from the Substance of the *Uterus*, by the strong Pressure when the Pains were violent, or from the Rupture of some small Vessels, either of the *Uterus*, or some other Part of the Abdomen, I do not determine; for I could not observe the least Appearance of any ruptured Vessels in either, after the most accurate Search I could make; nor was there one Drop of Blood in any other Part of the Cavity of the Abdomen. I know not if this is a Thing that is always observed in such Cases, having had no Opportunity before that Time, or since, to examine any such Subject; tho' no Doubt it is a Thing may readily happen in very laborious Births, and then it is no Wonder that violent After-Pains, Fever, Inflammations, and their Consequences follow; for in such a bad Habit of Body,

Body, as Women in these Circumstances are generally allowed to be in, it is scarce to be supposed that coagulated Blood can be easily dissolved, and again absorbed by the Vessels in so large a Cavity as that of the Abdomen: wherefore by its Stagnation and Putrefaction, it may bring on a Train of bad Symptoms; the Cause of which lying entirely out of the Physician's Power to know, it need be no Surprize though he fail in his Attempt to remove them; and I do not know but this may be one of the chief Causes of these many Disorders and frequent Deaths that happened after very violent and laborious Births, though there are many other Causes well enough known which are capable of producing such-like Effects.

This Phænomenon being what had never occurred to me either in Reading or Practice, I thought it would not be unuseful to acquaint the World therewith, to prompt those of greater Abilities, or who have more Leisure and more Opportunities of meeting with proper Subjects, to enquire, if such a Case often happens; how far the Causes hinted at are just; or what other Causes may probably be assigned for it; what Signs it may be discovered by; what Method of Cure might be proper in such an Event, and the like.

When I had removed this coagulated Blood, I observed a large Sac or Bag full of Water, lying along the Side of the *Uterus*, above the Intestines, and reaching as high as the Kidney of the right Side; upon feeling it all round with my Hands, I found it was loose at its superior Part, and appeared to come out from the *Pubes*,

bis, where only it had any Attachment: This upon Examination proved to be the *urinary Bladder*, thus distended to a vast Bigness, and thrust to one Side by the Pressure of the *Uterus* on the Fore-part of the Abdomen; I opened it, and measured the Urine, it contained no less than eight *English Pints*, or a *Scots Quart*.

The *Uterus* was pretty closely contracted upon the Child, and in opening it from the *Fundus* to the *Cervix*, I found it at least half an Inch thick in the thinnest Part of it, though a good deal more at its *Fundus*, where I observed the *Sinuses* so large, as easily to admit the End of my little Finger into them. The *Placenta* adhered to the Fore-part of the *Fundus*. The *Waters* having been broke so long before, I could not expect to find the *Allantois*.

The Child had fallen down into the Passage, much in the natural Way, only with its Head a little obliquely to one Side, so that Part of the *frontal* and *parietal* Bones of the right Side rested upon the *Os Pubis* and Neck of the Bladder; and by the Violence of the Pains, these Bones had been pushed so strongly against the *Pubis* as to make a considerable Indentation in them, and raised an Inflammation for an Inch or two round the contused Part.

I believe I need scarce add, that if Assistance had been called in Time, the Swelling of the Bladder might have been prevented, by drawing off the *Urine* with a *Catheter*: And if the Child's Head could not be easily stirr'd, then the Child might have been turned, and brought away by the Feet as is usual in such Cases.

Hence Midwives ought to be advised to call
for

for Assistance in due Time, especially in a Case of this Nature, where both the Mother and Child's Life is in so great Danger, though there be no Flooding, since it is one of the most difficult Cases can well happen in Midwifery, and thereby they may save two Lives, and secure their own Reputation.

Hence also Physicians and Surgeons may take Warning not to trust too much to the Report of Midwives, who too often pretend all things are in a fair Way, and that there wants only some Medicine to promote the Pains that they suppose are too faint and languid, because the Head does not fall any lower by the Pains, while it may be owing to the above Cause, as well as others mentioned by practical Writers, when the giving of such Medicines may be of the worst Consequence.

XXXIV. Books omitted in the former Volumes of this Collection.

Michaelis Bernhardi Valentini *Architatri Hassiaci & Prof. Med. Gisseni Historia simplicium reformata, seu musei museorum titulo antehac in vernacula edita, jam autem in gratiam exterorum sub directione, emendatione & locupletatione Autoris à D. Joh. Conradó Beckero Medico Alsfeldensi, Latio restituta. Accedit India literata è lingua Belgica primum in Germanicam translatā, nunc verò ad desiderium exterorum Latinitate donata, longè auctior reddita, novisque figuris illustrata à Christophoro Bernhardo Valentini M. B. filio, Fol. Offenbaci ad Mænum 1733.*

De

De Terra Tokayensi, à Chymicis quibusdam pro solari habita, Tractatus Medico-physicus; Autore D. Daniele Fischero Hungaro, 4to, Vratislav. 1732.

Remedios de deplorados, probados en la Piedra Lidio de la experienzia. Su Autor D. Francisco Suarez de Ribera Medico, Madrid 1732.

Nuove ed crudite osservazioni, storiche, mediche e naturale di Hieronymi Caspari M. D. 8vo, Venetiis 1731.

Alberti Haller de musculis diaphragmatis dissertatio Anatomica, 4to Bernæ 1733.

Cartilla Fisiologica, Galenico-espagirica Mathematico-medica escrita par el D. Don Iuan Gimenez de Molina. Madrid 1732.

De Urinis tractatus duo, Autore H. I. Rega in celeberrima Lovaniensium Universitate Med. P. P. 12mo, Lovanii 1733.

Examen de Cirurgia nuevamente annadido con las operaciones su Autor el D. Don Martin Martinez. Madrid 1732.

Cæsar Magati de rara medicatione vulnerum, Libri duo. Accessit Jo. Bapt. Magati *Tractatus quo rara vulnerum curatio contra Sennertum defenditur, cum Præfatione Frid. Christian. Cregut.* M. D. 2 Vol. 4to, Amstelod. 1733.

Clave Medico-cirurgica su Autor D. Francisco Suarez de Ribera Medico. Madrid 1731.

Restauracion de la Medicina antiqua su Autor D. Francisco Suarez de Ribera Medico. Madrid 1731.

Saggio di Medicina Teorico-practica di Carolo Gianelli Phil. & Med. D. 8vo, Venetiis 1732.

Miscellanea Physico medico mathematica Vratislaviensis

Vratislaviensia Ann. 1728, 4to, Erford, 1732.

XXXV. An Account of the most remarkable Improvements and Discoveries in Physick, made or proposed since the Beginning of the Year 1734.

Father Regnault (in his *Origine ancienne de la Physique nouvelle*) has revived the Dispute concerning the Discovery of the Circulation of the Blood, alledging that Harvey was taught it by Fabricius ab Aquapendente, to whom it was communicated by Father Paul, who again was, according to our Author, prevented by Cæsalpinus. Father Regnault also follows the Example of the other Writers, who endeavour to rob our Countryman of the Honour of this Discovery, in quoting Passages from Hippocrates, Plato and Seneca, in which, he thinks, the Circulation is described; nor does he omit the Knowledge which the Chinese are said to have had of it 4000 Years ago.

Dr. Tronchin (in his Dissertation *de Clitoride*) quotes several ancient Authors who knew the Clitoris, and proves Bonaciolus to have mentioned it before Columbus or Fallopius.

Mr. Morand gives a short History of the lateral Operation for the Stone, and argues that the Methods of Celsus, Frere Jacques, Rau and Cheselden are in the main the same. *Memoires de l' Acad. des sciences 1731.*

In the End of the Year 1724 and Beginning of 1725, the Royal Society at London published Accounts they had received from New-England concerning Ambergris. In the first, (See Trans-Vol. IV. H h aet.

act. Numb. 385. § 11.) Dr. Boylston of Boston writes the Society the Information he had from the Whale-Fishers. One of these Fishers, having accidentally found a large Piece of *Ambergris* in a Bull-*Sperma-ceti* Whale, the other Fishers always afterwards searched carefully for *Ambergris* in the Bodies of these Creatures. They affirmed to the Doctor, that they never met with any except in the Male of the *Sperma-ceti* Whale and scarce in one of a hundred of these. When they found it, it was, they said, contained in a Cyst or Bag near the genitall Parts. The Bag having no Inlet or Outlet, was sometimes found empty, tho' intire. According to the Report of these Men, the *Ambergris*, when first taken out, is moist, and of an exceeding strong and offensive Smell.

The other Account of the *Ambergris*, published by the Society, Numb. 387. § 2. was sent by the Honourable *Paul Dudley*, on the Faith of one Mr. *Atkins*. It is more particular than the former, but agrees with it in this principal Part, viz. that *Ambergris* is sometimes found in a Bag situated at the root of the *Penis* of Whales, and therefore is an animal Substance.

The Papers now mentioned have given Rise to a long Treatise on *Ambergris*, by Dr. *Neuman* Professor of *Chemie* at *Berlin*, published in the *Philos. Trans.* Numb. 433. § 5. Numb. 434. §. 1. Numb. 435. § 1. in which the learned Professor relates all the Opinions concerning *Ambergris*, with the Reasons for and against those of them that are not altogether absurd, and examines in a critical Way these

Accounts

Accounts sent from New-England; from which he endeavours to prove, that what the Fishers took for *Ambergris*, was no other than *Calculi* contained in the Urinary Bladders of Whales, at least that it was not *Ambergris*: The chemical Analysis of which, shews it not to be an animal Substance; for it affords no urinous volatile Spirit or Salt, but on the contrary, a small Quantity of an acid Salt, exactly like to Salt of *Amber*, is got from it. Near the Conclusion of this Treatise, he communicates his Method of making a right Tincture of *Ambergris* in Spirit of Wine; which, he says, other Chemists could not do. The Process is very simple, it is only to put a twelfth Part of *Ambergris* broke into small Pieces, among well dephlegmated Spirit of Wine, and then to expose them to such a Heat in a Glass as makes the Spirit begin to boil.

The Quantity of *Ambergris* used by Dr. *Neumann* in the chemical Analysis above-mentioned, having been very small, some *London* Chemists analysed larger Quantities, and their Experiments are published in *Transact. Numb.* 435 § 2. The Principles it yielded were very like to those got from *Succinum*, only Mr. *Brown* could obtain no acid Salt. Mr. *Godefrey* obtained twice a subacid Phlegm like weak Vinegar, and in his third Trial the Phlegm rather appeared to be impregnated with a neutral Salt.

Mr. *Petit* the Physician concludes, from a great many Experiments he made in covering Pieces of Flesh with the different Sorts of Astringents employed in Hæmorrhagies, that some act only as Absorbents, such are earthy
H h 2 Substances,

Substances, most of the astringent Plants, some Gums, Resines, and animal Substances. Other *Astringents* absorb, and at the same time their saline and sulphureous Particles insinuating themselves into the Flesh, preserve it from Corruption. *Vitriol* and *Allum*, which are acknowledged to be among the strongest Astringents appeared by Mr. *Petit's* Experiments to absorb most Humidity. *Memoires de l' Acad. des sciences* 1732.

Mr. *de Maupertuis* having caused *Scorpions* to bite several Animals, of which very few died, or suffered any more than the Pain of the Sting, is of Opinion, that *Oil of Scorpions*, and other vulgar Antidotes to the Poison of these Animals, have rather got their Reputation from the Innocence of the Sting of these Creatures, than from any considerable Vertue in the Medicines. *Memoires de l' Acad. des sciences* 1731.

Mr. *Vincent Bacon* relates what he observed in a Man who had eat *Monkshood*, *Napellus*; or *Aconita Spicæ Florum Pyramidali Morison. Prælud. Bot.* in a Sallad drest with Oil and Vinegar, after a Supper of Pork. Immediately after eating the Sallad, the Man felt a tingling Heat, which did not only affect his Tongue, but his Jaws, so that the Teeth seemed loose: and his Cheeks were so much irritated, that the People about him, nay even his Looking-glass, could scarce perswade him that his Face was not swelled to twice its proper Size. This tingling Sensation spread itself farther, till it had taken hold of his whole Body, especially the Extremities. He had an Unsteadiness in the Joints, especially

especially of the Knees and Ancles, with Twitchings upon the Tendons, so that he could scarce walk across the Room; and he thought that in all his Limbs he felt a sensible Stop or Interruption in the Circulation of his Blood, and that from the Wrist to the Fingers Ends, and from the Ancles to the Toes, there was no Circulation at all: But he had no Sickness, or Disposition to vomit, till, suspecting himself to be poisoned, he drank a large Quantity of Oil, not less than a Pint in all, and after that he loaded his Stomach with *Carduus-Tea* till he vomited; and though he threw up the greatest Part of his Supper, yet his Symptoms still increased. His Head grew giddy, and his Eyes misty and wandering. Next, a Kind of humming or hissing Noise seemed continually to sound in his Ears, which was followed by Syncopes. Some Spirit of Hartshorn, being poured into his Mouth, rouzed him a little, and set him first a coughing, and next a vomiting. Being plied with *Carduus-Tea*, he vomited several Times more, but swooned often between the Times of Reaching, notwithstanding that forty or fifty Drops of *Sal Volatile* and *Tinctura Croci* were given in a Glass of Wine, after each Time of Reaching. At length he began to find a Working downwards, which was followed by a Stool; after which he vomited two or three Times more, and then said, his Head was so heavy, and his Strength and Spirits so exhausted, that he must needs ly down. His Pulse was then a little returned, tho' very much interrupted and irregular, sometimes beating two or three Strokes very quick together, and

then making a Stop of as long or a longer Time than the preceeding Strokes altogether took up. Having observed that what he had last vomited was little more than the pure *Carduus-Tea*, Mr. *Bacon* gave him a Draught made of *Aq. Epidem. Theriac. Androm. Conf. Alkerm. &c.* and gave Orders to make him some Sack-Whey to drink between Whiles, sometimes alone, and in Case of great Faintness, with some of the above-nam'd Drops. - He lay awake, though still, an Hour or two; but being very cold and chilly, had a great deal of Covering laid on him, and then found a kindly Warmth come over his Limbs, which was succeeded by a moderate Sweat, and then a quiet Sleep of four or five Hours, from which he awaked very much refreshed. Next Day in the Forenoon he was much amended, and was capable of answering Questions with regard to Strength, his Senses never failing him but during the Swoonings. In three Days he was quite well.

A Woman, who had eat a little of this Salad, felt and complained of the same Symptoms, but in a less Degree than the Man. She would not be prevailed on to vomit, and remained longer out of Order. *Philos. Transact. Numb. 432. § III.*

Mr. *Quesnay* in his *Essai physique sur l'oeconomie animale*, p. 87, infers, from the Effects of Heat upon Oils, how much the Nature of oily Medicines may be changed in preparing them, according to their being longer or shorter heated or boiled; and therefore that Surgeons should have a particular Care to adapt them by this

this Means to the various Cases for which they are to be applied.

Dr. Morgan (*Mechan. Practice of Physick*, Prop. vii.) gives it as his Opinion, that the mechanical Effects of Medicines may be reduced to these six. 1. Repletion and Depletion. 2. Rarefaction and Condensation, or Heating and Cooling. 3. Solution or Fluxilization, and Olfaction or Inspissation. 4. Derivation and Revulsion. 5. Constriction and Relaxation. 6. Stimulation and Pacification.

Dr. Neuman Professor of *Chemey* at *Berlin*, having related to the *Royal Society of London* his Remarks on the hard crystalliform Substance found in the Oil of *Thyme*, and other Plants, affirmed it to be so like to *Camphire* as to deserve that Name (*Vid. Trans. Num. 389. § 2.*) Mr. Brown Chemist of *London*, very soon after (*Num. 390. § 2.*) made Remarks on Dr. Neuman's Paper, and mentioned several Experiments, by which it appeared that common or oriental Camphire differed considerably from that crystalliform Substance, which Mr. Brown chuses to call *coagulated Oil of Thyme*, and thinks the Name of *Camphire* improper. Dr. Neuman (in *Num. 431. § 2.*) acknowledges the Differences between these Substances, but still argues, that it is as proper to give the Name of *Camphire* to those crystalline Bodies in Oils, as it is to reduce Metals, Salts, &c. under the same Classes.

Mr. Boulduc has given much the same Description of the Manner of making *Epsom-Salt*, as Mr. Brown had done in *Philos. Trans. Num. 377. § 10* and *Num. 378. § 11.* to wit, that it

is the Salt which crystallizes after boiling to a due Consistence the *Bitterns*, which is the Liquor remaining in the Salt-Pans after the Sea-Salt for common Use is all separated. *Memoires de l' Acad. des sciences* 1731.

Mr. Boulduc also describes *Seignette's Sal Polychrest*, which has been long esteem'd in France; it is a soluble Tartar made with *Sal Kali*, instead of *Salt of Tartar*. *Ibid.*

The Method hitherto employed for making *Tartar* or its Crystals *soluble*, has been by saturating them with an *Alcali Salt*; but now Messrs. *Groffe* and *du Hamel* have shewn, that all Lime, Chalk or Earth that is dissolvable by Vinegar will serve for making *Tartarus solubilis*. *Histoire & Memoires de l' Acad. des sciences* 1732..

Mr. *Homberg*, by dissolving *Borax* in Water, into which he poured Oil of Vitriol, and then distilling this Mixture, obtain'd his *quieting Salt*. Mr. *Geoffroy* has lately taught us an easier Way of preparing it; for instead of sublimating, he evaporates the Liquor to the proper Consistence, and then allows it to crystallize; which Crystals answer all the Characters of the sublimed Salt. *Ibid.*

The common Opinion is, that all the animal Liquors, excepting Chyle and Milk, are of an alcalefcent Nature; but Mr. *Quesnay* (*sur l'oecon. anim. p. 144.*) affirms, that " our gelatinous Liquors contain a very acescent Salt capable of resisting a Heat of 200 Degrees. The Proof of which, says he, offers itself daily to every one. Who is it who has not remarked, that Broth made with Flesh well freed from Fat,

" when

"when corrupted, becomes as sour as Ver-
"juice?"

The Foundation on which Mr. Quesnay builds his Doctrine concerning animal Liquors, is the Separation of Milk into its oily, cheesy and watery Substances, by which, he says, p. 165, the Genealogy of our Humours begins. In the Blood he remarks, 1. The albuminous Juices, 2. The fatty, 3. The gelatinous, 4. The biliary, And 5. The watery Liquors. Which, according to him, comprehend the four predominant Humours of the Ancients. Their *Blood* being the oily or fat Part of the Chyle. Their *Bile* is the same with the salino-sulphureous Part of that Oil. Their *Melancholia* or *black Bile* takes in his albuminous and gelatinous Liquors, which is the caseous Part of the Chyle, and the *Pituita* is the watery.

Mr. Hunauld has the following Observations on the Fat of the Body: 1. That tho' Foetuses and Children have much Fat under the Skin, yet they have only a small Piece or two (*Pelotons*) at the Base of the Heart, whereas even lean adult Bodies have Fat all round the Base, on the Vessels that go out of the Heart, and accompanying the larger coronary Vessels, and at the Point of the Heart. 2. That the *Omentum* of very young Children has no Fat, and their Mesentery has very little. 3. That in many People the Fat under the Skin is exhausted, while the Bowels are overcharged with it. 4. According to him, the exterior Part of the *Tunica cellularis* is the first filled with Fat, and the last emptied of it. From which, and seeing *Aponeuroses* and Membranes spread over so many

ny Muscles, he concludes, the common Opinion of Muscles being lubricated by the Fat, to be ill founded. *Histoire de l'Acad. des sciences.* 1732. LXXXI. p. 100.

The common Opinion concerning the Ossification of Bones is, that they are first Cartilages, which, by Pressure, and the Addition of an Ossifying Juice, are gradually hardened into Bone. Dr. Nisbet, in his *human Osteogeny*, undertakes to demonstrate, "that the Notion of all, or any Bones being originally cartilaginous, is without Foundation in Nature."

1. He observes, That several Bones are formed between Membranes, without the Appearance of any Cartilage. He is so just however to those who differ in Opinion from him, as to allow (p. 15.) that some of these which he calls Membranes are so like to Cartilages, that no less an Anatomist than Kerckringius affirms them positively to be Cartilages; and, p. 39, says, "We find most of these Bones (formed in Membranes) even when their Ossifications are far advanced, to be either so exceeding thin, or very small and slender, that a cartilaginous Substance of their Size could not have much more Solidity, than the Membranes between which those Bones are produced."

2. The Doctor, supposing the Favourers of the common Opinion to know nothing of Liquors circulating in Cartilages before and while they ossify, and consequently to believe that no other solid Particles form Bones than what were in the Cartilages formerly, refutes them, p. 30, from the Bulk of the Part not having been greatly

greatly diminished in ossifying, the Bulk and Weight of all animal Substances, except Bone, depending indisputably much more on their fluid than solid Parts. And, p. 33, from Bones, when burnt, leaving a greater Quantity of Earth than Cartilages do.

3. Cartilages are often harder, and Bones are softer than ordinary; but our Author, p. 25, never found any Particles or Fibres in a middle State between Bone and Cartilage, and therefore concludes the softer Substance not to be gradually transmuted into the harder.

4. In Answer to the Experiment of steeping Bones in Vinegar, whereby, it has been said, they may be brought to a cartilaginous State; Dr. Nisbet tells us, p. 31, that if Bones are steeped long enough, and the Vinegar is often enough changed, Bones may be reduced to a spongy Substance, which is very different from Cartilages.

The Doctor's own Opinion of Ossification is, (p. 27.) that in the Blood, or a Fluid secreted from it, there is an ossifying Juice consisting of Particles which are not apparent; that (p. 17, 25.) when ever Nature designs an Ossification between Membranes, or within a Cartilage, she, (*some Cause or other*) occasions a more than usual Afflux of Fluid, which distends so much the Vessels which were before invisible, as to make them capable of receiving the red Globules of Blood, which is always to be seen near to where Ossification is begun. In this Blood (p. 18.) gritty bony Particles are to be felt by the Point of a Knife, which (p. 28.) have been formed by the Attraction and Co-hesion

hesion of the Particles of the ossifying Juice obstructed, along with the other grosser Fluids in the Beginning of the Vessels, prepared to receive refluent Juices. "The Blood being capable of forming fine Membranes, the membranous Parts of a Bone, which act as a *Gluten* to keep these Particles and Fibres together, if there be any such, that do not arise from the Coats of its Vessels, are produced by a Cohesion round the cretaceous Particles of a Part of the Fluid, in which they were generated and contained." Thus, (p. 10, 38.) the Membranes or Cartilages serve as a Bed between, or within which the bony Particles are deposited or shoot; but (p. 21.) without any Intermixture of the Particles of the Bone and Cartilage, or Continuation of the Fibres of one Substance to those of the other; as, *says he*, is evident in Cartilages containing Bones kept long enough in Water, and then slit; for the Bone will, as soon as the large Vessels that enter its Substance are divided, slip as easily, if not easier, from it, than an Acorn does out of its Cup: And there is a Smoothness and Polish of the Parts of both Cartilage and Bone, which shew there is no Conjunction or Union of the Fibres of the two Substances. While the Bones are increasing within Cartilages, (p. 34, 35.) the Cartilages are extended and spread out, by which, with the Pressure which they suffer, and the great Influx of various Fluids, and the nutritious Matter being hindered to flow freely into them, they decrease continually, and at last may truly be said to be entirely destroyed.

Mr.

Mr. Weitbrecht has described and delineated
a Ligament, which had not been observed by
Anatomical Writers, stretched from the poste-
rior Part of the anterior Extremity of each
Clavicle behind the *Sternum*, to the same Part
of the other *Clavicle*, which makes the Arti-
culation of the *Sternum* and Clavicles stronger.
Comment. Acad. scient. Petropolitan. Tom. IV.
p. 255.

Mr. *Weitbrecht* has also described and painted some Bones and Muscles of the Hand more accurately than is to be found in other Books: What Corrections he has made will not admit of being told in fewer Words than the Author has used. *Ibid.* p. 234.

The Improvements made by Mr. *Albinus* in his *Historia Musculorum*, will as little allow of an Abridgement, and therefore we must refer to the Book itself. We cannot but regret that he has given us no more Plates than four, representing the Muscles, Ligaments and Bones of the Hand, which are most accurate and elegant.

Dr. Morgan, in his *Mechanical Practice of Physick*, Prop. XII. repeats the Objections he had made in his *Philosophical Principles of Medicine*, to muscular Contraction being owing to the Influx of a Fluid of the Nerves into the muscular Fibres. The principal of these are, 1. The Vesicles in an animal Body being all distractile, such a Fluid would distend the Vesicles of the Muscles in every Direction alike, and consequently, by such Influx, Muscles would be made longer, instead of being shortened, as they really are. 2. In accounting for

the Motion of the Heart, those who would have it to depend on the animal Spirits, are, *says he*, brought into the Absurdity of making the Secretion of the Brain to depend on the Contraction of the Heart, and the Contraction of the Heart to depend on the Secretion of the Brain, which is running Things into a Circle without any Cause. Or suppose these two to be set at first miraculously in Motion, yet the Resistances, that would be met with, would necessarily put soon an End to that Motion. Weights and Springs, which act by their constant uniform Force of Gravity and Elasticity, are the only Causes of continuing Motion in a resisting Medium. To Elasticity then it is he ascribes the Motion of Muscles, as is more fully explained in his Principles. We wish the Doctor would impartially try the Application of the Objections he has made to the common Opinion, likewise to his own Doctrine.

In *Schol. 1.* of this *Prop. XII.* he particularly attacks *Boerhaave's* Arguments in favour of animal Spirits, which, he thinks, the Professor gives up, by acknowledging that they cannot be exhibited to any of our Senses.

In *Schol. 2.* He laughs at the Opinion of Secretion being only owing to the Laws of Circulation, and thinks some Concoction or Fermentation necessary. Nor will he allow that all the Liquors secernd have first entred the Blood-vessels, insisting still, as he had done formerly, that the Urine passes from the Stomach to the Bladder, without entring into the common Course of the Circulation.

Dr. Morgan (*Mechan. Pract. Prop. VI.*) en-
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deavours to shew that Dr. *Juryn* (*Dissert. de motu aquarum fluentium*) “ has confounded three perfectly different and distinct Laws of Motion, namely, the Law of communicating Motion by Impulse, the Law of Gravity in general, and the particular Law of Pressure in Fluids;” and then examines the Paradox, concerning the Circulation of Liquors in Animals, advanced by Dr. *Juryn* in that Dissertation, to wit, that the *Momentum* or *Impetus* of the Blood is greater at the Extremities of the evanescent Arteries than at the Heart. The contrary of which, Dr. *Morgan* thinks, is clearly demonstrated by the greater Thinness of the Coats of the small Arteries than of the large ones, and from the Capacities of all the Branches of every Artery being so much greater than of the Trunk itself, while the same Quantity of Blood passes through the Trunk and Branches in the same Time.

In *Schol. of Prop. V.* he roughly criticizes Dr. *Robinson*’s Laws of Motion in Fluids, and afterwards attacks the Doctrine which Dr. *Robinson* has borrowed from Sir *Isaac Newton* concerning the Acid in the Air, which they supposed necessary for the Life of Animals, and to preserve the Action of Fire and Flame. (See our *Vol. I. p. 340.*) Dr. *Morgan*’s principal Objection to this Doctrine is, that Acids extinguish Fire, and acid Vapours are more suffocating and destructive than any common watery Fume or Vapour; and Acids cannot effervesce with the Blood; nor do they increase, but rather diminish Heat.

Our Author’s Opinion of the Use of Air to
I i 2 Fire

Fire and Animals is, that it serves as a proper exhaling Medium to receive and carry off those copious Discharges of humid *Effluvia* or moist Vapour, which all living Creatures, and all combustible Matter under the Action of Fire, are incessantly emitting and throwing out, and consequently, for want of such an exhaling Medium as that of the Air, those vast Quantities of humid Vapour being thrown back, and not discharged or carried off, the Life of Animals, and the Action of Fire must soon be suffocated and extinguished, after the same Manner, and by the same sort of mechanical Necessity.

Anatomists in their Figures and Descriptions of the *Brain* only represent the Cavities that are seen upon separating the Hemispheres, and taking away the *Corpus callosum*, without observing that the *Crura forniciis* sink down, and then turn forwards on each Side of the *Medulla oblongata*, in Cavities which are extended far forwards, under the commonly-known anterior Ventricles. In these inferior Cavities the *Crura forniciis* are of a beautiful Form, resembling a white Silk-worm, or Sea-horse; on which Account they were called *Hippocampi* by Julius Cæsar Arantius, who is the only Author who has given any Description of them, till lately Mr. Du Verney has revived them, by an exact Description and Delineation.

Mr. Du Verney also observes, that the *Septum lucidum* between the anterior Ventricles has a Cavity between the two *Lamellæ* of which it is composed, in which he has often found Water, and that the internal Side of the *Septum* is made

made rough, by a great many small Grains and Papillulæ. *Comment. Acad. Petropol. Tom. IV.* p. 130.

The French Anatomists have of late disputed, whether or not the Heart is shortened in its *Systole*, tho' all allow that it is then straitned.

— In Dissections of living Creatures, the Motions of the Heart are so quick, convulsive and irregular, that it is scarce possible to determine this Question by them.— If it is said, that the longitudinal Fibres contracting will make the Heart shorter; it may be answered, that the transverse Fibres, being much stronger than the longitudinal, may prevent their Action.— The Valves at the Orifices of the Ventricle of the Heart being evidently stretched towards the Point of the Heart in its *Diastole*, when the Blood rushes into the Ventricle, and these Valves being raised towards the Base of the Heart in its *Systole*, to prevent the Blood from returning into the Auricles; which Motions of the Valves seem to depend on the Relaxation, and on the stretching of the tendinous Cords, by which the Valves are connected to the Sides of the Ventricle, appears to be one of the strongest Arguments for the Heart being shortned in its *Systole*, especially that these Motions of the Valves can be seen, by alternately raising and letting fall the Point of a Heart filled with Water, and held with the Base upwards. But even this is not conclusive; for in making the last mentioned Experiment, the Motions of the Valves are the same, when the Sides of the Ventricle only are pressed without the Point being raised or depressed.

— Nor is there any Consequence to be drawn in favour of the Heart's being lengthened in its Systole, from its Pulsation felt at that Time on the Ribs ; because that Pulsation may as well be owing to the Heart's being raised by the stretched, distended Auricles and Arteries, as to the increased Length of the Ventricle.

Hist. de l' Acad. des sciences. 1731.

According to Mr. *Quesnay* (*l'oecon. animale*, p. 227.) the Motions of the Heart and the Circulation of the Liquors depend on the Motion of the Lungs, which sending the Blood forcibly into the left Auricle, revive and increase its Elasticity and Contraction by this Shock, which the Auricle communicates to the Ventricle, which affects the Arteries in the same Way ; and these do the same to the Veins which act upon the right Auricle, and that upon its Ventricle : And thus the Circulation is continued.

Mr. *Lindern* Physician at *Strasburg* relates two Observations, which contradict the Doctrine of violent Trituration, said to be performed by the Stomach in Digestion. 1. A Dog having swallowed a Dice, vomited it eleven or twelve Hours after ; when the bony Part of the Dice was much diminished, but the Pins of Wood on which the Spots are marked were entire, and stood out a considerable way from the Bone. 2. Three Stomachs of Swine were crusted so thick over their interior Surface with a stony Substance, that all their Cavity was filled except a Canal in the Middle, of about an Inch diameter : Notwithstanding this, the Flesh

of

of the Creatures was fair and sound, and sold well. *Hist. de l'Acad. des scien.* 1732.

Ruysch, (*Advers. Dec. 3. Tab. I. Fig. 4, 5, 6, 7.*) painted the meseraic Arteries and Veins as having different Courses in the Distribution of their Branches in the Intestines. Dr. *Albinus* (*Dissert. de arter. & ven. intestin.*) attributes this Mistake to *Ruysch*'s having injected the Arteries at one Part of the Intestines, and the Veins at another ; and by a Figure representing the internal cellular Membrane of the *Ilium* with both Arteries and Veins injected, shews their Courses to be the same.

Mr. *Du Vernoy* is of Opinion, that the *Valvulae conniventes* of the Intestines are formed by the arched Vessels and Fat in the internal cellular Coat, and covered by the villous or nervous Coat. *Comment. Acad. Petropol. Tom. IV. p. 192.*

Every body knows the many Opinions which have been given concerning the Use of the Spleen. Mr. *Du Vernoy* has added one more to the Number. From observing a large empty Space, near the Spleen, in the Abdomen of a dead Body ; the proportional Largeness of its Blood-vessels, and the Structure of the Spleen analagous to that of the *Penis* ; he concludes the Spleen in a living Person to be subject to Inflations like a Bellows : But how it is thus to be moved, or to what Purpose, he does not tell us. *Ibid. p. 156.*

Dr. *Rega*, in his *second Treatise on Urine*, mentions the Opinion of some modern Authors, who imagine that our Drink passes thro' the Coats of the Stomach and Bladder, and not

not in the ordinary course of the Guts, Lacteals, &c. when it is so quickly evacuated by Urine, as it is observed to be after drinking several Mineral Waters and other Liquors. He shews this to be no new Opinion, it having been mentioned by *Hippocrates* and *Asclepiades*; and then he endeavours to prove, by an easy Calcul of the Quantity of Urine secreted in the Kidneys, that they are capable of furnishing all the Quantity observed at any Time. And lastly, he mentions the Fulness and greater Frequency of the Pulse after drinking these diuretick Liquors, as a Proof of their being mixed with the Blood.

Dr. Morgan (*Mechan. Pract.* p. 246.) after several Arguments taken from the *Chlorosis*, and other Symptoms which appear after Obstructions of the *Menses*, and observing that Blood-letting does not supply this natural Evacuation, concludes that the *Menses* are not designed only for evacuating a superfluous Quantity of arterious Blood, but that there is then a very different and very independent Secretion, or a Derivation of a certain excrementitious and redundant Lymph or Serum, from the membranous Cells and Ventricles of the Glands in general, but chiefly from those Parts of the *Membrana cellulosa*, which are more directly and immediately connected with the Kidneys, *Uterus* and *Ovarium*.

Dr. Neufville, in his *Dissertation* on the *Allantois*, § 10, affirms, that a Liquor injected by the human *Urethra*, after the Bladder is blown up, will come out at the *Urachus*; as it will, he says, likewise do, upon gently pressing

sing a Bladder filled with Liquor, while the *Urethra* is tied. He also informs us, that Mr. *Albinus*, Professor of Anatomy at *Leyden*, shewed his Students the *Urachus* of an Adult, which was pervious, and allowed the Urine to pass an Inch from the Bladder. And (§ 24.) that Mr. *Albinus*, in 1730, shewed the *Allantois* of a human Foetus about seven Weeks old, loosely connected by small Fibres, and placed betwixt the *Amnios* and *Chorion*, exactly where the *Placenta* adheres to the *Chorion*; it was like an oblong Bladder, and much more capacious than the Bladder of Urine. The *Urachus* likewise appeared distinctly in the umbilical Rope towards its Side, like a small Thread, and terminated in the *Allantois*.

Dr. *Hunauld*, Royal Professor of Anatomy of *Paris*, has communicated some Thoughts on the Operation of the *Fistula lacrymalis*, and proposes that no Tent should be put into the Perforation of the *Os unguis*, because the Tears will of themselves keep it open, and the Tent, by its Pressure and Irritation, may occasion Inconveniences, *Philosoph. Transact. Numb. 437.*
§ 5.

The itinerant Oculist Dr. *Taylor* (in his Treatise on the Diseases of the *Crystalline Humour* of the human Eye) seems to aim at something new in the Operations he describes, but expresses himself in a Manner that makes us suspect we may mistake his Meaning: We shall however for once try our Skill in explaining profoundly obscure Authors.

In couching a *Cataract* or opack *Crystalline*, he makes a small Puncture with a Lancet, through the

the Coats of the Eye, in the ordinary Place of piercing with a Needle in this Operation; then introducing his Needle at this Puncture, he directs its Point to the lower Edge of the *Cataract*, and raising the *Cataract* a little with the Side of the Needle, he observes whether it moves directly upwards, without being turned forwards or backwards. If the *Cataract* thus moved is neither pressed nearer to, nor farther from the *Iris*, he draws back the Needle some Way; and as soon as the *Cataract* descends to its former Situation, he pushes the Needle quickly into it, and breaks its lower Edge, by forcing the Needle through it, and some little Way, into the Substance of the vitrous Humour. When this is done, he draws the Needle back again, and then directs its Point to the upper Part of the *Cataract*, upon which he presses in different Directions, till he sees, by the perpendicular Motion of the *Cataract*, that the Needle is right placed, when he uses more Force to thrust the alter'd *Crystalline* out at the Aperture already mentioned to have been made in the lower Part of its *Capsula*. When ever he sees the *Cataract* passing through this Opening, he brings back his Needle to it, and pushes the *Cataract* into the divided Part of the vitrous Humour, and then takes his Needle out of the Eye.

In what he calls the *shaking Cataract*, or where the alter'd *Crystalline* has got out of its *Capsula*, and floats in the aqueous Humour; the Operation, according to him, is much the same as in the *true Cataract*; only that the Part of the former Operation, whereby the *Capsula* of

of the *Crystalline* was opened at its lower Edge, is omitted, and the Needle must be placed farther forward in the Eye, in depressing the *Cataract*.

The *false Cataract*, according to Dr. *Taylor*, is the *Crystalline* reduced to a fluid State with an opack *Capsula*, in which he advises first to perform the same Operation as in the *true Cataract*, and afterwards to separate the *Capsula* all round from its Adhesions with the *Ligamentum ciliare*, that it may also be depressed into the vitrous Humour.

The *Glaucoma* is said by our Author to be the *Crystalline*, with its *Capsula* become opack and enlarged in its Volume; for removing which, he proposes the Separation of the *Capsula*, with its included *Crystalline*, and their Depression into the vitrous Humour, in the same Manner as was proposed for the *Capsula* of the *false Cataract*.

After these Operations, Dr. *Taylor* drops a Mixture of the Tincture of *Bals. Peruvian.* with warm Water, into the Eye; and then applies, upon the Eye, a Cataplasm made of some Drops of the Mixture, with *Pulp of Cassia*. This Cataplasm is to be renewed every four Hours of the first two Days, each Time fomenting the Eye, half an Hour, with a spirituous Fomentation in which there is *Camphire*. He then gives free Motion to the Eye-lids, but keeps a Shade over the Eyes for some Time.

The *Cæsarean Operation* is recommended by several Authors, and some Examples have been recorded, of the Mother having been saved by it; notwithstanding which, Women are frequently

quently allowed to die with their Children buried in their Womb, without this Attempt being made for saving either. To encourage Practisers to do their Duty, by performing what Art directs for saving Patients in desperate Circumstances, Mr. *Helvetius* communicates to the Academy of Sciences at *Paris* a well-attested History of a Woman recovering after the *Cœsarean Operation* had been performed upon her by a Midwife, *Hist. de l' Acad des sciens.* 1731.

Mr. *Petit* the Surgeon, in examining all the different Methods employed by Surgeons for stopping Hæmorrhagies, assures us, that in each of them a Piece of clotted Blood is contained in the Vessel, which serves to keep the Blood from escaping after the Effect of the Medicine first employed ceases. Where *Absorbents* or *Astringents* are used, there is, he says, not only a cylindrical Piece of clotted Blood in the Vessel, but there is a Covering of it on and round the Orifice of the cut Vessel; which cylindrical Form, makes it easily pushed out at the Extremity of the Vessel; and therefore the Hæmorrhagy is in Danger of returning, when it is stopped by such Medicines.— *Causticks* have much the same Effects, only the Covering on the Extremity of the Vessel is firmer by the solid Parts being confounded with the clotted Extravasation.— When a *Ligature* is used, there is no clotted Covering, and the internal Plug is of a pyramidal Figure, the smaller Extremity being nearest to the Ligature; therefore it is with Difficulty that such a clotted Piece can be pushed out. Besides this Advantage, the Sides of the Vessel, which are brought to be contiguous by

by the Ligature, will probably grow together; and on both these Accounts, there is much less Risk of a fresh Hæmorrhagy, after tying Vessels, than in the other Methods above-mentioned.—*Compression* rightly applied, to wit, on the Sides of the Vessel, renders the clotted Plug of such a Form as cannot easily escape at the narrow Orifice; and a large Surface of the Sides of the Vessel being made contiguous, they will grow sooner and more firmly together than in any other Way: For which Reason, and the saving both Pain to the Patient, and Loss of Substance of the Stump, he prefers *Compression* to all the other Methods. *Mémoire's de l' Acad. des scien.* 1731. In Proof of the Effects of coagulated Blood stopping the Efflux of Blood from large Arteries, he relates two Histories; in one, the Artery was ossified; and in the other, it lay in a bony Groove: So that in both, it must have been a Plug which prevented the Hæmorrhagy. He endeavours to prove, that the *Caillot* or *Plug* is stronger and firmer when formed of coagulated Lymph, than when it is composed of red Blood. *Ib.* 1732.

For executing the Compression right, after Amputations of the larger Extremities, he has contrived a Machine, composed of a large circular Belt, to be put round the Trunk of the Body, or superior Part of the Member, which is to sustain the Bandage, by Straps going from it, which are fastned at the other End to a lesser circular Belt that is put round the Part of the Member where the Tourniquet is commonly applied. This lesser Belt is to have two Plates with Screws, &c. in the Form of his

Screw-Tourniquet, described *Memoires de l'Acad. des sciences* 1718, and now generally known, and is to serve the same Purposes of stopping the Blood during the Operation, and in the Time of each Dressing, and to moderate its Course at all other Times. From this lesser Belt, four Straps go out, to cross over two Plates with their Screws, as in the Tourniquet placed on the Stump. When the Operation is performed, he applies thick Bolsters of Lint on the Side of each large Artery farthest from the Bone, and placing the interior convex Plate of the small Tourniquet on them, he secures it in the right Situation with the four Straps, and screws down the Plate on the Bolsters and Vessel, which being pressed between the Instrument and the Bone, can allow no Blood to pass.

Ibid. 1731.

Dr. Desaguliers has contrived a Machine for changing the Air of the Chamber of sick People in a little Time, by either drawing out the foul Air, or forcing in fresh Air; or doing both successively, without opening Doors or Windows: A Figure, Description and Account of which are inserted into the *Philosoph. Transact.* Numb. 437. § 1, 2, 3. which we cannot abridge.

Mr. Quesnay (*l'art de guerir, par la Saignée*) observes, that the Effects of Blood-letting must be, 1st, To empty the Vessels, which he calls *Depletion*. 2dly, To take away more of some Sorts of Liquors than of others, which he calls *Spoliation*. The *Depletion* may soon be supplied by new Chyle, but this Chyle is not so soon reduced into the Nature of the Liquors taken

taken away ; therefore though the first Effect of Blood-letting may cease very soon, the second will continue longer, and is the principal. The red Globules, according to our Author, must be most affected by the *Spoliation*, because of their small Proportion to the other Liquors, and their quick Circulation in the larger Vessels ; whence he infers, that the great Effect of Blood-letting is to render the Fluids more serous, and to weaken the Solids.

From considering, says Mr. *Quesnay*, p. 47. all the Effects of Blood-letting, it must be concluded, that there is only Place for Bleeding when the Liquids disturb the Action of the Solids, or when the Solids cause Disorder in the Fluids. For when the Solids or the Liquids are found defective absolutely, or in themselves, the bad State of neither of them can be repaired by Bleeding.

It is impossible to make such an Abridgment as our Design allows, of all the particular Cases in which he examines, whether Bleeding is useful or not ; only we may in general observe, that there are very few Diseases in which he thinks it may not be of Advantage to let Blood.

Dr. *Langrish* (*Modern Theory and Practice of Physick*) gives us Tables of the different Proportions of *Serum* and *Gore*, and the different Powers of Cohesion between the red Globules which constitute the *Crassamentum*, as also the Proportions of the different Principles obtained by a *chemical Analysis* from the *Blood*, and from the *Urine* in different Kinds of Fevers, and in their several *Stadia*.

P. 66. He tells us the Manner in which his
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statical

statical Experiments were made : 1. " He always took Care to bleed into a Porringer as near the same Shape and Size as possible, because a larger Surface of Blood should not be exposed to the Influence of the Air in one Trial than in another. 2. All the Blood was received in one Porringer, because he has found by Experience, that a Pound of Blood does not separate so much Serum, when divided into several Parcels, as when contained in one Vessel. 3. He always set the Blood in a cool Place ; and after it had stood twenty four Hours, he very carefully weighed the Serum and *Cruor* separately, in order to find their different Proportions, 4. He took a very thin Glass-Tube, 12 Inches long, and $\frac{1}{3}$ Inch diameter, and having hermetically sealed up one End of it, he blowed it out to an obtuse Point, about the Bigness of a midling Pea. Now this Point being set upon the *Graffamentum*, the Weight of the Tube was not of itself sufficient to press through, and but very seldom, when filled with Water ; so that his way of trying the Cohesion of the *Gore*, was to pour Mercury into the Tube, till it was just heavy enough to cut its Way through ; and as the Tube was exactly graduated, he could, by this means, very nicely determine the Power of Cohesion between the Globules which constitute the *Graffamentum.*"

By the Tables of Dr. Langrish's statical Experiments made on the Blood of People in acute continual Fevers, p. 68. compared with what he says of the Blood of three young Men in

in perfect Health, p. 74 ; it appears that in such Fevers the Serum is in less Proportion, and the *Crassamentum* is more viscid and tenacious than in Health. The Indications of Cure from which are plain.

By the chemical Analysis, p. 80. it was proved, that in acute Fevers the saline and sulphureous Parts did abound more than in Health. And, p. 94, that the Urine was impregnated more and more with these saline and sulphureous Principles, as the Symptoms abated upon a Crisis by Urine.

Dr. *Friend* had recommended Bleeding at the jugular Veins, in a Phrenzy coming upon a Fever, which Dr. *Langrish*, p. 131, endeavours to prove rather to be hurtful : 1. Because of the Ligature's stopping the Blood some Time. 2. Because opening the external Jugular cannot make a Revulsion from the internal Parts; since not only the Resistance to the Blood in the common Trunk of the *Carotid* is thereby diminished, but also the Resistance to that which comes out of the Heart is also diminished, which will therefore send more by that common Trunk, and consequently as much as formerly by the internal Carotid. 3. After the Orifice of the Jugular is shut, there is some Reason to believe that the Blood continues to flow more by the superior Branches some Time, which will do Harm. 4. He thinks the Cases mentioned by Dr. *Freind*, for proving his Opinion, either do it not, or can be turned against him.

By our Author's Experiments in intermitting Fevers, p. 229, the *Crassamentum* of the Blood

is not so viscid and tenacious; neither is the Serum so bilious, saline and acrid, as in acute continual Fevers; and the red Globules abound more, and the *Cruor* is more viscid and tough in *Quotidians* than in *Tertians*, and in *Tertians* than in *Quartans*.

The Epidemick Fever, described by Dr. Douglas, seized a half of the Inhabitants of New-England, and killed one in thirty-five; in some Places one Sixth, one Fourth, or one Third of the Sick died.—The greatest Number of those labouring under this Epidemick Disease, after the common Symptoms of a Fever, had Swelling, Pain, and white Specks in the *Uvula* and *Tonsils*, and a distinct, red, miliary Eruption over all, (or a breathing Sweat that smelled as the Eruption did) which was at the Height the fourth Day; after which it itched and scaled off, and the Specks slough'd off from the subsiding *Fauces*. They generally did well.—A worse Kind of this Fever was accompanied with a low unequal Pulse, Prostration of Strength, Despondency, colliquative Vomiting, Purging or Sweats, chop'd *Tonsils*, with brown or livid Spots; the Eruption darker-coloured, or appearing and disappearing; *Ichor* or *Pus* coming by Mouth or Nose from Parts out of Sight; mucous *Exuviae* sloughing off the Tongue, *Oesophagus* or *Bronchia*. Many thus affected died the sixth or seventh Day.—In the worst Sort, the Pulse and Strength were still lower, the Colliquations were greater; and the Sick had a sinking Pain at the Stomach, *Stupor*, *Delirium* or *Convulsions*, and an intolerable *Fætor*. The few

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thus seized died the first, second or third Day. This Fever was seldom too high, and the Patients generally recovered when left to Nature, with a temperate Regimen. Evacuations, particularly Blood-letting, hastned Death, or retarded the Cure. Hot Cordials also did Hurt. Snakeroot-Tea, or Sp. C. C. and a little Wine supported the faint and weak, and promoted the salutary breathing Sweats. Profuse Sweats and Diarrhoeas were stopt by *Ol. Cinam. Decoct. alb. Elixir. Vitriol.* and toasted Rhubarb. Calomel, which made the Evacuation they bore best, and Gargles of *Tinct. Myrrh* and *Aloes* helped off the Sloughs, and kept the Throat moist. — This epidemick Disease was followed in some with Discolourings, Hæmorrhagies, &c. like those in the Scurvy, which were cured by Milk-diet, Peruvian Bark and *Elixir Vitrioli*. In others with Tumors, which resolved with mercurial Plaisters and Purging, but supplicated, with Cataplasms; and, when supplicated, spread by Digestives, but cured with spirituous drying Applications. The nervous Symptoms, such as hysterick Ails, Melancholy, Fatuity, &c. remaining with others, were soon removed by a restoring Diet.

Dr. Cohausen in his Book, entituled, *Archaeus Febrium Faber & Medicus*, recommends the Quinquina or Jesuits Bark in intermitting Fevers, but mentions several Rules to be observed before it is given, while it is used, and after taking it. He condemns the Use of Purgatives as Preparatives for the Bark, and recommends Emeticks, especially in mesenterick Fevers, where the *primæ viæ* are stuffed. He re-

recommends *the Bark* to be given immediately after the aguish Paroxysm, and to repeat the Dose every four Hours; and is of Opinion it has better Effects when taken with a bitter stomachick Wine than in Pills, and it is still more effectual when some Green Tea is drank with it. While *the Bark* is used, and in the Intervals of Paroxysms, he says, Exercise is of great Use.

Though our Author is very fond of *the Bark* in the Cure of intermittent Fevers, he cautions Practisers to be very careful not to give it to all Patients, or at improper Times; because, tho' it may put off the Fever, it occasions Swellings, Dropsies, Pains of the Belly, Obstructions of the Bowels, and a great many other Diseases, (of which he gives several strong Examples) that are more dangerous and worse to cure than the Ague is. The best Method, he says, to remove these bad Symptoms, is to bring back the Fever, for which Etmuller recommends volatile Spirit of *Sal Ammoniack*; our Author thinks a Wine in which resolving diuretick and deterfisive Medicines are infused would be safer. He tells us, the People of *Westphalia* seldom miss to bring back the Fever when necessary, by eating a high-smoaked Sow's Head.

Mr. Cohausen is of Opinion, that the continued remitting Fevers which are periodical in their Remissions, are of the same Nature with Agues, and ought also to be cured by *the Bark*, unless they are of a malignant Kind, accompanied from the Beginning to the End with Cold.

Coldness and a weak Pulse; in such Cases, Diaphoreticks are the proper Medicines.

The German Physicians seem at present to be divided in their Opinions concerning *Blood-letting* in the *Small.Pox*, some still adhering to the hot *Regimen*, while others recommend Venæsection as the Medicine most to be depended on. Dr. Burghart Physician at *Breslaw*, in Support of his Friend Dr. Tralles, Physician in the same Place, his Treatise on the Use and Necessity of Blood-letting in the variolous Fever, proves by numerous Observations of the good Effects of Hæmorrhagies from the Nose and other Parts of the Body, and Venæsection in the variolous Fever, that in a great many Cases it is the chief or only Medicine from which the Prevention of the worst Symptoms is to be expected, though perhaps it is not necessary to every Patient under this Disease.
Mantiss. ad Specim. 1. Satyr. Medic. Silesiac.

Dr. Calderwood (in his new *Method of curing the Apoplexy*) condemns the common Method of letting Blood from any Vein, giving Emetics or sharp Clysters, and applying Blisters: But insists much on the Advantage of *Arteriotomy*; and recommends Cordials in the Cure of the Apoplexy.

Dr. Astruc has wrote a regular and compleat Account of the Origin, Nature, Symptoms, Prognosticks and Cure of the *Lues Venerea*. In which, after examining critically all the Arguments that have been used in Proof of the *Lues* having been known in *Europe* before the Conquest of the *West-Indies*, he thinks them insufficient; and concludes, that it was brought from

from the Island *Haiti* or *Hispaniola* by the *Spaniards*, who being employed in the Defence of *Naples*, attacked by *Charles VIII.* King of *France*, communicated this Disease to the Inhabitants of that Country, and to the *French Army* in 1494, when it was first taken Notice of; and therefore was called the *Neapolitan or French Disease.*

He thinks the Reason why the Inhabitants of *Hispaniola*, and some other hot Countries, had the *Lues* endemick among them, was, the Heat of the Climate, and the promiscuous Coition of their Women even in the Time of their *Menstrua.*

After having observed, that several Diseases have had their Progress and Periods, and that the *venereal Disease* is gradually become more mild, our Author is hopeful that it may also wear out.

Dr. *Astruc* proves this Disease always to be communicated here in *Europe* by Infection; and modestly conjectures, from the Effects of its Poison, that it is of an acid or acido-saline, corrosive and fixed Nature.

It is impossible for us, in the narrow Bounds we are confined to, to follow our Author in his Aetiology, Diagnosis, Prognosis and Cure of the several *Stadia* of the *vénereal Disease*, which he distinguishes very accurately, both when it affects the whole Body, or any particular Part of it, and when it is attended with no other Disease, or complicated with others. We shall only remark, that he proves the *Gonorrhœa* to affect the *Prostata* and *Vesiculæ seminales* in Men, as well as the mucous Glands, and

and Cowper's and Littre's Glands, to which it is confined by several Authors: And that he prefers the Salivation by Inunction to every other Method for curing the *Lues*.

We shall conclude this superficial Account of Dr. Astruc's Book, with a Censure he makes, which we wish our Countrymen would shun to deserve. In giving the Character of a particular English Writer, he says, *Ordine parum composito differitur, saltem non eâ methodo quæ lucem afferat, & quam in Anglorum medicorum operibus plerumque desiderari dolemus.*

Pudet hæc opprobria, &c.

Dr. Morgan (*Mechan. Pract.*) recommends several uncommon Methods of Cure in different Diseases; the most remarkable of which we shall mention.

The Tincture of *Cantharides* is, according to him, p. 114, a Medicine that may almost be absolutely depended on for checking, restraining and stopping the immoderate Flow of Urine in a *Diabetes*. He chuses to make this Tincture by infusing or digesting half an Ounce of *Cantharides* upon a Pound of the *Elixir Vitrioli*, of which Tincture, from 15 to 30 or 40 Drops may be given twice or thrice a Day, as the Symptoms may indicate; and the best Vehicle is the *Bristol Hot-well Water*.

Prop. XIII. is employed in inculcating the Advantages of curing Fevers by Sweating; raised by low cooling Drinks in the effluent or inflammatory Fevers, and by the warmer *Regimen* in influent or nervous Fevers. In which last he recommends Blisters much, especially when soon applied; and proposes that the blistering

blistering Plaisters should be left on four or five Days, or as long as they will draw off any thing.

The Cure proposed by the Doctor, p. 179, for *Intermittents*, which he assures us is much preferable to the common Practice, is to give a Vomit about an Hour after the Invasion of the cold Fit; which being wrought off, the Patient goes to Bed, and is put as soon as possible into a large and copious Sweat, to be continued, and succoured by plentiful Dilution, for six or eight Hours. This Method, three or four Times repeated, scarce ever fails, he says, of curing a *Quartan*, especially if the Person afflicted use the cold Bath every Day between the Fits. But in a *Tertian*, this Method, once or twice repeated, makes commonly a Cure.

In *petechial* and *malignant Fevers* there is, in our Aurhor's Opinion, no Hope but from Sweating, which it is impossible to raise and maintain uniformly and equally in these Cases, without the most powerful and effectual Blistering.

He esteems Sweating and loose Stools of the greatest Advantage in the *Small-Pox*; and likewise proposes it as a Cure for the *Gout*, *Sciatica*, and *Rheumatism*.

Sweating sustained with proper Diluters, is also recommended by him in dry Coughs. After the dry Cough, and Catarrh which follows it, is throughly fixed, he never found any thing effectual but giving *Calomel*, or some such moderate Mercurial, to raise a slight and gentle Salivation.

He thinks the *Fluor albus* is the Lymph corrupted, and assures us the *Tincture of Cantharides*

rides given in a pretty strong Decoction of *Guajac*, has good Effects in its Cure when recent. But where this Disease is of long standing and inveterate, Recourse must be had to Mercurials.

P. 255, He appears to be no Friend to *Blood-letting*, making it Matter of Advice and Request to all younger and unexperienced Physicians to be sparing of human Blood, to see an absolute Necessity of it before they spill it, &c.

P. 271, When *Opium*, says the Doctor, affects the Head or Lungs, by its volatile, æthereal Oil or Spirit, Acids, especially fossil Acids, are the proper Correctors. When *Opium* produces Sickness, Nauseas, Vomitings, Spasms, flatulent Colick Pains, and such like Symptoms, by the Action of its ponderous, stimulating and adhesive Oil, the warmest Alexipharmicks must be used.

P. 278, According to our Author, the most effectual Medicines in scorbutick Disorders are mercurial Deobstruents. He has found the following Medicine very successful : Rx. *Mercur. viv. unc. ii. Terebinth. Drachm. ii. vel q. s. ad Mercur. fixandum; cui adde Rhubarb. Unc. i. sem. Cochinel. Unc. sem. & cum Elixir. Propriet. q. s. fiat massa pilularis.* This commonly proves an effectual, safe and benign Diuretick. While it is taking, the Patient is now and then to be moderately sweated. If the Pills ever raise a Salivation, the Force of the Mercury on the salival Glands may be easily prevented or restrained at Pleasure, only by rinsing the Mouth pretty often in a Day with a Solution of *Camphire* in the Oil of *Olives*.

P. 354, For the Cure of the Scurvy, he proposes that the Patient should be put into a warm or hot Bath for half an Hour or forty Minutes, till the Pores are all opened, and the Sweats are moderately raised and brought out : And then let him be taken out, and immediately immersed in cold Water for half a Minute, or just Time enough to dip the Head two or three Times, and then taken out again and put to Bed, in order to keep up a pretty free flowing Sweat for three or four Hours, to be maintained and supported with any of the common warm Diluters, such as Sage-Tea, Wine-Whey, Posset-Drink, &c. At the same Time the Parts affected may be slightly touched every other Night going to Bed, with the *Ung. Neapolitan.* or something equivalent, in every Ounce of which a Drachm of the prepared *Cantharides* has been mixed and incorporated, first reduced to the most subtle Powder. And upon this any common sudorifick Draught or *Bolus* may be given, to be supported with Diluters as before, in order to keep up a moderate breathing Sweat for the Night.

XXXVI. A List of Medical Books published since the Beginning of the Year 1734.

A Dissertation on the State of Physicians among the old Romans, by Dr. Conyers Middleton, 8vo, London 1734.

Remarks on Dr. Middleton's Dissertation, translated from the Latin of P. W. M. D. 8vo, London, 1734.

An Account of Alexander Trallian, one of the Greek Writers that flourished after Galen ; shewing

shewing that these Writers are far from deserving the Reputation of mere Compilers, by Edward Milward M. D. 8vo, London 1734.

Oratio Harvæana in ædibus Collegii regalis Medicorum Londinensium habita Oct. 18. A. D. 1735, ab E. Wilmot, 8vo, Londin. 1735.

Disquisitio Physico-medica de natura aquæ & quænam sit saluberrima, à Joanne Baptista de Malmedie. M. D. 12mo, Augustæ Eburonum 1735.

Description des Plantes qui naissent, ou se renouvellent aux environs de Paris, avec leurs usages dans la medicine & dans les arts, le commencement & le progres de cette science, & l'histoire des personnes dont il est parlé dans l'ouvrage, par M. Fabregou Botaniste & demonstrateur, Tome I. 12mo, à Paris 1734.

A Treatise of the fossil, vegetable and animal Substances made Use of in Physick, containing the History and Description of them, with an Account of their several Virtues and Preparations, by Stephen Francis Geoffroy M. D. translated by George Douglas M. D. 8vo, London 1735.

Histoire generale des Drogues simples & composées, par Pomet : nouvelle Edition, corrigée & augmentée, par le Sieur Pomet fils, Apothecaire, 2 Voll. 4to, à Paris 1735.

Mechanica Medicamentorum : Autore Joanne Baptista Mazino Brixiano in Gymnasio Patavino Med. Pract. Prof. 4to, Brixiae 1734.

Pilulæ Wardianæ dissectio & examinatio : Ward's Pill dissected and examined, and its true Composition plainly discovered even to ocular Demonstration. In a Latin Epistle to

the ingenious Dr. Boerhaave; now translated into English, 8vo, London 1736.

Dispensatorium regium Electorale Borusso-Brandenburgicum variis observationibus locupletatum, ab Ernesto Fagino Augustano, Fol. Erford. 1734.

Pharmacopœia Collegii regii Medicorum Edinburgensis. Editio tertia. 8vo, Edinburgi 1735.

Boerhaave's Chemistry translated by Timothy Dallowe M. D. with several Corrections and Emendations by the Author's Approbation, 2 Voll. 4to, London 1735.

Remarques de Chymie touchant la préparation de différentes remèdes usitées dans la pratique de la medecine, 12mo, à Paris 1735.

Abregé de l'Anatomie du corps humain, où l'on donne une description courte & exacte des parties qui le composent, avec leurs usages, par M. Verdier Chirurgien juré de Paris, 2 Voll. 12mo, à Paris 1734.

Oribasii Anatomica ex Galeni Libris, cum versione Latina J. Bapt. Rasarii. Curante Guilielmo Dundas, cuius notæ accesserunt, 4to, Lugd: Batav. 1735.

Human Osteogeny explained in two Lectures, illustrated with Figures accurately drawn from the Life, by Robert Nisbet M. D. 8vo, London 1736.

Bernardi Siegfried Albini Anat. & Chir. in Acad. Batava quæ Leidæ est Professoris, *Historia muscularum hominis, 4to, Leidæ Batav. 1734.*

Tractatus quatuor Anatomici de aure humana, tribus figurarum tabulis illustrati, Autore Joan.

Joan. Friderico Cassobhom M. D. & Prof.
P. 4to, Halæ, 1734.

De vasis linguae salivalibus atque sanguiferis
Epiſtola Christoph. Jacobi Trew M. D. 4to,
Norimberg. 1734.

Bernard Siegfried Albinus *Anat. & Chir. P.*
de arteriis et venis intestinorum hominis ; ad-
jecta icon coloribus distincta, 4to, Leidæ Batav.
1736.

Dissertationes Medicæ de membrana allan-
toide, Autore Ludovico de Newfville M. D.
De clitoride, Autore Theodoro Tronchin M. D.
Editio nova emendatior & accuratior, 8vo,
Lugd. Bat. 1736.

De præcipuis humoribus qui humano in cor-
pore reperiuntur, deque eorum historia, quali-
tatibus & officiis exercitatio Josephi del Papa
Med. in Pisana Universitate Prof. 4to, Flo-
rent. 1733. Recus. in 8vo, Lugd. B. 1736.

Fundamenta Physiologica, sive positiones, ho-
minis statum sanum ad officia sibi in hoc mundo
expediunda necessarium, delineantes. Autore
D. Detharding M. D. & Physic. P. 8vo, Haf-
niae 1735.

Dissertatio de graviditate debitum gestationis
tempus excedente, seu diurna, Autore Joanne
de Buchwald M. D. 8vo, Hafniæ 1734.

Essai physique sur l'oeconomie animale, par
François Quesnay Chirurgien, 12mo, à Paris
1736.

Chirurgia Theorico-practica de vulneribus,
Autore Petro Guisard M. D. Monspeliensi,
12mo, Avenione 1735.

Chapman's Treatise of Midwifery, second
Edition with Additions, 8vo, London 1735.

A Treatise on the immediate Organ of Sight,
by John Taylor M. D. 8vo, London 1735.

A new Treatise on the Diseases of the crystalline Hymour of a human Eye; or, of the Cataract and Glaucoma, by John Taylor M. D. 8vo, London 1736.

Dr. Taylor couch'd for a Cataract: Wherein the Absurdity of his new Treatise on the Diseases of the crystalline Humour, as likewise his Theory of the Causes of Cataracts, is fully demonstrated, by J. S. Surgeon, 8vo, London 1736.

L'art de guerir par la Saignée, ou l'on examine en même tems les autres secours qui doivent concourir avec ce remede, ou qui doivent lui etre préférées dans la cure des maladies tant medicinales que chirurgicales, par François Quesnay Chirurgien, 12mo, à Paris 1736.

The Fountain of Health, by H. Bourdon, 8vo, London 1734.

Elementa diætæ sive regulæ Physico-medicæ ad sanitatem conservandam, vacillantem fulciendam, deperditam verò citò, tutò & jucundè magis recuperandam, Autore K. Detharding M. D. Hafniæ 1735.

Traité du bon Chyle pour la production du sang, ou l'on voit, entre les causes ordinaires qui le corrompent, plusieurs maladies qu'on n'a pas connues. Il contient aussi les moyens de les prévenir, & les remèdes pour les guérir. Par M. Viridet Docteur en Medicine à Morge, 2 Volls. 12mo, à Paris 1735.

Roberti Welsted tentamen alterum de propriis naturarum habitibus, remediisque ad singulos accommodandis, 8vo, Londini 1735.

Pauli

Pauli Gottlieb Werlhofii M. D. *cautiones medicæ de limitandis laudibus & vituperiis morborum & remediorum*, 4to, Hanover. 1734.

Demonstratio Medico-practica prognosticorum Hippocratis, ea conferendo cum ægrotorum historiis in libro primo & tertio Epidemiorum Hippocratis, ab Henrico Cope Medico regio ad statum in Hibernia, 8vo, Dublini 1736.

Hippocrates upon Air, Water, and Situation, upon epidemical Diseases, and upon Prognosticks in acute Diseases especially. To this is added, by way of Comparison, *Thucydides's Account of the Plague of Athens.* The whole translated, methodized and illustrated with useful and explanatory Notes, by Francis Clifton M. D. 8vo, London 1734.

The Aphorisms of *Hippocrates*, and the Sentences of *Celsus*, with Explanations and References to the most considerable Writers in Physick and Philosophy, both ancient and modern, by Sir Conrad Sprengel Knight, M. D. The second Edition enlarged, 8vo, London 1735.

The practical History of an *Epidemic Fever*, with an *Angina ulcusculosa*, by William Douglas M. D. 8vo, Boston in New-England 1736.

An Essay on the Practice of Physick: Or an Attempt to revive the Practice of the Ancients. With some general Observations on animal Mechanism and the *Materia Medica*, by Andrew Hook M. D. 8vo, London 1734.

Instruzione intorno alle febre di Joanne Dominico Santorino Proto-medico Anatomico, 4to, Venetiis 1734.

A short and certain Method of curing continued Fevers, second Edition, 8vo, London 1735.
Medical

Medical Practice in curing Fevers, by *Theophilus Lobb M. D.* and *F. R. S.* 8vo, *London 1735.*

The *Arcanum* concerning Horses explained; an Introduction to Physick, with the Method of Fevers, 8vo, *London 1734.*

The modern Theory and Practice of Physick, by *Browne Langrish M. D.* 8vo, *London 1735.*

A rational and mechanical Essay on the Small-Pox, by *William Hillary M. D.* 8vo, *London 1735.*

A new Method of curing the Apoplexy, by *John Calderwood M. D.* 8vo, *London 1735.*

De Catalepsi Schediasma: unà cum historia mulieris catalepticæ, Societati regiæ communica à Richardo Rynell Pharmacopœo Londinensi, 4to, *Londini 1736.*

A Treatise of sudden Deaths, by *Nicolas Robinson M. D.* The second Edition, 8vo, *London 1735.*

Dissertation sur la petrification d'un epiploon, par *M. Mongin M. D.* 12mo, à Paris 1734.

A Preservative against the miserable Consequences of the Bite of a mad Dog, 8vo, *London 1734.*

A Treatise on the Rheumatism, as well acute as chronical, by *John Cheshire M. B.* 8vo, *London 1735.*

Observationes circa Scorbutum, ejusque indolem, causas, signa, & curam institutæ, Autore *Joanne Friderico Bochstrom M. D.* 8vo, *Lugd. Batav. 1734.*

Système de M. Herman Boerhaave sur les maladies veneriennes, traduit en François, par M. de la Mettrie M. D. avec des notes & un *dis-*

dissertation du traducteur, sur l'origine, la nature, & la cure de ces maladies, 12mo, à Paris 1735.

De morbis venereis libri sex: in quibus disseritur de origine, propagatione, & contagione horumce affectuum in genere: tum de singulorum natura, Aetiologia & Therapeia; cum brevi analysi & epicrisi operum plerorumque, quæ de eodem argumento scripta sunt. Auctore Joanne Astruc Regi à consiliis medicis, &c. 4to, Parisiis 1736.

A new Method of curing (without internal Medicines) that Degree of the venereal Disease called a Gonorrhæa or Clap, by *George Warren Surgeon*, third Edition, 8vo, *London 1734.*

A Treatise on the venereal Disease, in three Parts, by *Nicolas Robinson M. D.* 8vo, *London 1736.*

A Synopsis of the History and Cure of venereal Diseases, by *J. Armstrong M. D.* 8vo, *London 1737.*

Aphrodisiacus, containing a Summary of ancient Writers on the venereal Disease, by *Daniel Turner M. D.* 8vo, *London 1736.*

Consulti Medici del Signor Dottore Giuseppe del Papa, 2 Tom. 4to, Venetiis 1734.

*Friderici Hoffmanni consultationum & respon-
sorum medicinalium centuria prima complectens
morbos capitis & pectoris, Tom. I.*

*Earundem centuria secunda, complectens mor-
bos abdominis & artuum externorum, Tom. 2.
4to, Halæ 1734.*

The mechanical Practice of Physick. In which the specifick Method is examined and exploded, and the Bellinian Hypothesis of animal Secretion and muscular Motion is considered

ed and refuted, by T. Morgan M. D. 8vo, London 1735.

Boerhaave's Aphorisms translated into English, 8vo, London, 1735.

Systēma novum Mechanico-Hippocraticum de morbis fluidorum & solidorum ac de singulis ipsorum curationibus, opus Theorico-practicum Josephi Thomæ Rosetti Phys. & Med. Prof. Fol. Venetiis 1734.

Conspēctus Medicinæ Theoretico-practicæ Tabulis 138, omnes primarios morbos methodo Stahlianā tractandos exhibens, tertīā vice editus, correctus & auctus, Autore D. Joanne Junkero M. D. & Prof. 4to, Halæ 1734.

Philosophical Transactions for the Years 1734 and 1735, 4to, London.

L'Histoire & les Memoires de l'Acad. des sciences, Années 1731 & 1732, 4to, à Paris, 12mo, Amsterdam.

Commentarii Academiæ scientiarum Imperialis Petropolitanæ, Tom. 4. ad annum 1729, 4to, Petropoli 1735.

Miscellanea Berolinensia ad incrementum scientiarum, ex scriptis societati regiæ scientiarum exhibitis edita. Continuatio tertia, sive Tom. 4tus, cum figuris et indice materiarum, 4to, Berolini 1734.

Medicorum Silesiacorum Satyræ, quæ varias observationes, casus, experimenta, tentamina ex omni medicinæ ambitu petita exhibent, specimen, i. cum figuris, 8vo, Wratillaviæ & Lipsiæ 1736.

XXXVII. Books proposed, and other Medical News.

M^r. Fabregou promises to publish seven Volumes of his Description of Plants, to which the one mentioned p. 399 of this Volume is an Introduction.

There is now in the Press at Leyden, Bernhardi Siegfried Albini Anat. Prof. Offium fœtus humani icones 163 cum earum explicationibus, 4to.

Dr. Hook, in his Essay on the Practice of Physick, proposes to publish a new *Pharmacopœia*.

Dr. Edward Milward is to favour us very soon with a Treatise on the Peruvian Bark, in which he only proposed at first to consider it as a Specifick in Gangrenes, but as we are now informed, he is to examine all its Properties.

A Letter has been published, inviting all the Physicians living or born in Silesia, to communicate their Observations, Experiments, &c. any way relating to Physick, which are to be published under this Title, *Medicorum Silesiacorum Satyræ, quæ varias observationes, casus, experimenta, tentamina, ex omni medicinæ ambitu petita exhibent*. We suspect Dr. Burghart junior, Physician at Breslaw, to be the Collector.

F I N I S.

To the Bookbinder.

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